VOICE RELATED QUALITY OF LIFE IN SPASMODIC DYSPHONIA : TREATMENT EFFECTS AND CORRELATION WITH VOICE ASSESSMENT

K. J. Neumann[1], P. H. Dejonckere[2,3,4],

[1]J.W. Goethe Universität, Frankfurt-am-Main, Germany
[2]Utrecht University, Utrecht, The Netherlands
[3]Federal Institute of Occupational Diseases, Brussels, Belgium
[4]Catholic University of Leuven, Leuven, Belgium
COST-Action 2103 Advanced Voice Function Assessment
e-mail : ph.dejonckere@umcutrecht.nl

Abstract : **Spasmodic Dysphonia (SD) patients *(adductor type*) are known to score very high on the Voice Handicap Index (VHI). 28 VHI-analyses were performed in patients diagnosed with spasmodic dysphonia (SD), before and after treatment with botulinum toxin. Patient's voices were also analyzed perceptually and acoustically : 7 perceptual parameters (traditional and dedicated) were blindly rated by a panel of 3 experienced speech therapists and 9 acoustic measures (mainly based on voicing evidence and periodicity) were achieved by a special analysis program suited for strongly irregular signals. After treatment, the average VHI total score is reduced by 15.41 points (from 64,17 to 48,75), which may be considered as clinically relevant for a group design. A paired comparison pre-/post also demonstrates a significant improvement in voice-related quality of life (p = .039). The effect size is to be considered as medium to large (Cohen's d = .7). However, as well in pre- as in post-situation, there is no significant correlation between the VHI score and either the perceptual ratings or the acoustic measurements. Even the pre-/post differences in perception, acoustics or VHI do not correlate with each other. This points out that the patient's self-evaluation is a different dimension from the perceptual and the physical ones.**

Keywords : **VHI, Spasmodic dysphonia, acoustics, perception, botulinum.**

I .INTRODUCTION

The Voice Handicap Index (VHI), developed by Jacobson et al. [1] is a widespread instrument for measuring the psycho-social handicapping effect of a voice disorder over 3 domains, the Physical (P), the Emotional (E) and the Functional (F) domain. It is a disease specific quality of life instrument and consists of 30 items/statements (10 in each domain), which are to be scored from 0 to 4 with a maximum score of 120. The higher the score, the more there is a handicapping effect caused by the voice disorder.

'Adductor spasmodic dysphonia' (SD) is a focal laryngeal dystonia mainly resulting in a strained voice quality with spastic voice breaks and frequency shifts, perturbing fluency and intelligibility [2;3]. SD-voices form, in the same way as substitution voices, a particular category of voices that is not suited for a standardized basic multidimensional assessment protocol. SD-voices request specific parameters, as well perceptual as acoustic ones [4;5]. It is well known that SD-patients report unusually high scores on the VHI, even higher scores than total laryngectomees [6]. The present study deals with changes in the VHI-score in patients after treatment with Botulinum toxin injection in the vocalis muscles : what are pre-treatment scores ? can a clinical relevance of treatment be proved in patients with this specific disease ? Furthermore the correlation between the VHI scores and the perceptual / acoustic data is examined. Pre- and post situations are considered separately, as well as the pre-/post changes. Our approach is based on a differentiated perceptual rating and on a computerized program for signal analysis that appeared very promising in assessment of substitution voices [3;4]. This study is a part of a larger one.

II. MATERIAL AND METHODS

28 VHI forms were filled in and analyzed : 24 are originating from 12 patients diagnosed with adductor SD, and investigated (just) pre- and (a few weeks) post treatment. 3 patients had no post-treatment self-evaluation. 1 patient had 2 pre- self-evaluations at different moments, with a time interval of several months. There were 9 females and 6 males. Mean age was 60,6 (+/- 9,3) years.
All patient's voices were also digitally recorded (standardized list of 40 short German sentences, phonetically selected for being constantly voiced; sampling frequency of 44.100 Hz, quiet room) for blind perceptual evaluation and acoustic measurements. Duration of reading is about 2'30".

Perceptual parameters

They are scored on a scale 0 to 10, 0 meaning the worst possible rating, and 10 the best possible one. Scoring was performed blindly and independently by 3 experienced speech therapists, and averaged.

Traditional perceptual voice characteristics :

G (Grade)
B (Breathiness)
R (Roughness).

Perceptual voice characteristics dedicated to SD :

I (Intelligibility)
F (Fluency)
Vo (Voicing) in the sense that the speech is voiced or unvoiced when it actually needs to be voiced or unvoiced
S (Spasmodicity) : the specific perceptual characteristic of adductor spasmodic dysphonia, combining impression of strain, perception of spasms and tremor.

I, F and Vo are taken over from the INFVo rating scale developed for and investigated on substitution voices [7].

Acoustic parameters

An analysis program "Ampex" (Auditory Model Based Pitch Extractor) created (1992) and further developed by Van Immerseel & Martens [8] was used for the acoustic measurements. It provides following parameters :

PVF/PVS: PVF is the proportion of voiced frames and depends on the pauses appearing in speech. Also the PVS, the proportion of voiced speech frames is computed, thus considering only frames that are classified as speech in the first step of the analysis. The better the voice, the highest the percentages.

AVE: the average voicing evidence. The more regular (periodic) the voice frames are, the higher the AVE will be.

VL 90 parameter: This is the 90th percentile of the voicing length distribution. The voicing length is defined as the number of consecutive voiced frames found in the data. Phonatory breaks reduce this parameter.

Jitter: Period to period variability. Better voices show limited jitter.

Corrected jitter : As jitter is computed in running speech, also a corrected Jitter is computed . The correction means that only frames with a reliable Fo are taken in account ; reliable Fo is less than 25 % deviance from the mean over all voiced frames.

PFU:_The percentage of frames with "unreliable" Fo is considered as a second Fo-instability factor . Frequency shifts make Fo unreliable.

T max : The maximum length of speech without pause. In this experiment, T max actually accounts for the average time needed for reading one single short sentence (in total 40). Improvement in fluency shortens T max.

Furthermore the total time used for reading all the 40 sentences was computed (**Duration**).

III.RESULTS

(1) Treatment effect

Fig. 1 shows a histogram of the pre- and post-treatment VHI-scores : The observed averaged reduction in VHI-score is 15.42 points, from 64.17 (+/- 21.98) to 48.75 (+/- 22.54)

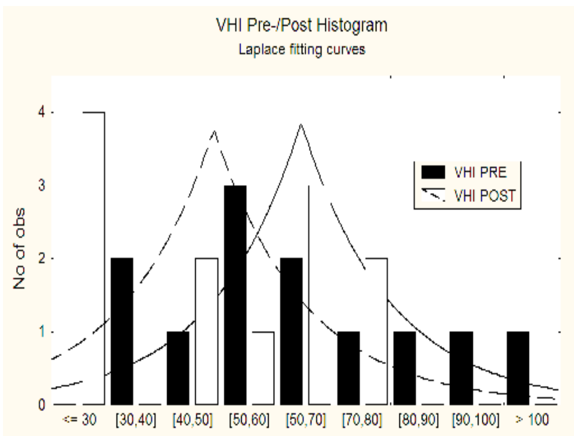

Fig. 1 : Histograms of pre- and post-treatment VHI-scores with Laplace fitting curves.

A paired pre-/post comparison also demonstrates a significant improvement in voice-related quality of life (p = .039). Fig. 2 shows individual effects.

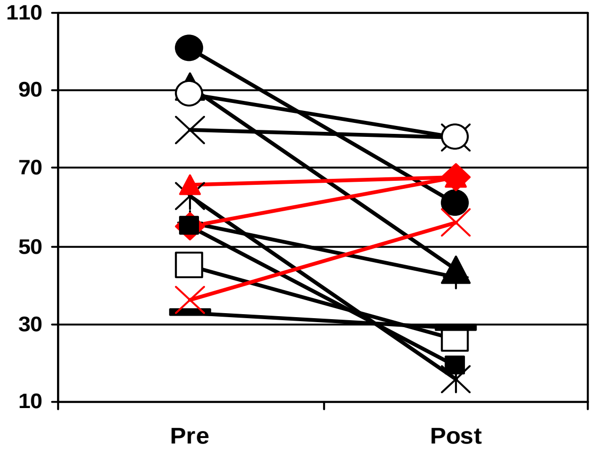

Fig. 2 : Values of the VHI-score for each patient, pre- and post-treatment

(2) Correlations

As well in pre- as in post-situation, there is no significant correlation between the VHI score and either the perceptual ratings or the acoustic measurements. Even the pre-/post differences in perception, acoustics or VHI do not correlate with each other.

There is also no significant effect of gender and age.

IV.DISCUSSION AND CONCLUSION

The median value for the VHI-score in the general population is 6 with an asymmetrical distribution (p 25 = 2; p75 = 12; p90 = 23; p95 = 32.8) [9]. None of our patients originally scores within the p95 range of the general population, but 33% shift to this range after treatment.

Regarding clinical relevant difference scores, van Gogh & al. (2007) found a difference score of 10 points to be useful for individuals in clinical practice and 15 points to be useful in study group designs [10]. In the current study, the average VHI total score is reduced by 15.42 points.

The same authors found no association between the VHI scores and the gender, neither for the normal population nor for the voice impaired patients.

Also regarding age, no clear associations were present either in the normal population or the voice impaired patients.

Effect size

In inferential statistics, an effect size helps to determine whether a statistically significant difference is a difference of practical concern. The effects size helps to know whether the difference observed is a difference that matters. In the current study, Cohen's *d* is for the VHI-score 0.692, and may be considered as medium to large.

The lack of any correlation with either perceptual ratings or acoustic measures points out that the patient's self evaluation is a different dimension from the perceptual and the physical ones.

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