A Stuttering Therapy Programme with Spastic Dysphonia - a Single Case Study

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METHOD

The subject, S, was an English speaking adult male, aged 34 years whose profession involved much public speaking. His voice problem

The past decade has brought about a dramatic transition in the theoretical foundation and purpose in the treatment of stuttering. Based on the factors which induce fluency in stutterers, remediation has shifted to manipulation of phonation utilizing behaviour modification techniques as a vehicle for establishing fluency (Shames and Florance 1980). Common to all 'fluency-based' programmes are advances regarding treatment approaches. While some authorities have described similar techniques to those constituting 'fluency-based' programmes, no one has as yet integrated these techniques into a unified therapy programme. In view of the limited investigations into the field of spastic dysphonia, and of the need to explore new avenues for treatment, the writers decided to investigate the effects of a fluency-based programme (developed for stutterers) by Shames and Florance (1980) on a subject with spastic dysphonia.

METHOD

The subject, S, was an English speaking adult male, aged 34 years whose profession involved much public speaking. His voice problem...
began at the age of twenty and since that time he has received treat-
ment in the form of psychotherapy, medication and traditional voice
therapy, all of which have provided little relief from the disorder.
No family history of spasmodic dysphonia has been reported. S's voice
was characterized by breaks in phonation caused by an intermit-
tent, strained-strangled and highly tense voice with reduced modal
pitch and voice intensity. Reflex actions of phonation were intact
and thus laughing and coughing were carried out normally. The
symptoms became more prominent as the communicative demands
of speech were increased.

PROCEDURE

PRE-INTERVENTION VOICE MEASURES

Pre-intervention samples were obtained over two days prior to the
initiation of treatment. These samples were analyzed subjectively
and objectively. All measures were obtained in a sound proof record-
ing room, in the phonetic laboratory, Department of Linguistics
at the University of the Wawatervrand, Johannesburg.

The three voice samples included:

(1) Sustained phonation of (i:) for 5 secs.
(2) Reading the first paragraph of the Fairbanks Rainbow Passage
(Fairbanks 1940).
(3) A spontaneous speech sample.

a) Subjective evaluation

The voice was recorded on the Uher 4200 stereo tape recorder.
Two independent raters judged the severity of the voice samples.
A rating scale adapted from Aronson et al. (1968) and Wilson (1979)
was utilized for the qualitative analysis (see Appendix I). Severity
was measured by classifying the subject's voice on a severity con-
tinuum based on Aronson et al (1968). The two raters who rated
blind as to whether the recordings were pre- or post-therapeutic,
calculated the frequency of occurrence of strained, squeezed, stac-
cato or effortful phonation (Aronson 1980) for both reading and
spontaneous speech. This constituted a measure of percentage and
strained-strangled syllables (%SS), which was to be used as an
equivalent of percentage stuttered syllables used for stutters. This
has been found to be a good indicator for treatment effectiveness
(Perkins et al. 1974).

Finally, a speaking and reading rate was calculated by counting
the number of syllables spoken in one minute. This was to consti-
tute a measure of syllables per minute (SPM), which is necessary
for determining the desired rate to be reached in the therapy
programme (Shames and Florance, 1980).

b) Objective Evaluation

The following measures were obtained by the principal phoneti-
cian in the Department of Linguistics, University of the Wit-
watervrand:

i) Laryngographic Tracings. Wechsler (1977) writes that
laryngographic tracings provide a qualitative description of
the voice, and show prefered qualitative estimates of vocal
fold regularity. Using a Fourcin laryngograph and
voicescope, the laryngographic procedure was carried out in
the manner described by Wechsler (1977) and Kelman

Hirano (1981) writes that tracings should be obtained from
both the steady position of sustained vowels, and the transi-
tional phases of phonation. The output of the laryngo-

graph and voicescope was simultaneously recorded on a
Mingograf inkjet recorder.

Each laryngograph was segmented into phonation
stretches of 100 m/sec. The stretches were analyzed ac-
cording to preselected categories from the features
presented by Wechsler (1977) and Kelman (1981),
and a frequency count based on visualizing these categories
was used (see Appendix II).

ii) Fiberoptic Examination. This measure was employed
to observe the laryngeal behaviours directly during con-
nected speech. Aronson (1980) and Chapey and Salzberg
(1981) maintain that fiberoptic examination is the only
means by which one can observe and describe vocal fold
behaviour, as well as co-ordinate the visual and auditory
aspects of voice production. A flexible fiberscope con-
nected by a c-mount adaptor to a type 4AZ Olympus OMI
camera was used for the fiberoptic examination. The tape
recorder was prepared to run concurrently with the ex-
amination so as to record all utterances. The vocal folds
were examined at rest, during deep breathing and during
a spontaneous speech sample. They were also examined
during the prolongation of (i:) at a comfortable loudness
and pitch level. The audio tape recordings correspond-
ing to each slide, derived from the fiberoptic examination,
were transcribed and two independent raters judged the
perceptual characteristics of each slide.

INTERVENTION PROGRAMME

The intervention was carried out daily by one of the writers over
a 3-week period. The programme employed was the 'stutter-free'
speech programme (Shames and Florance 1980). Based on the prin-
ciples of operant conditioning to modify behaviour, the programme
involves five overlapping stages which are systematically sched-
uled. The client is taught to deliberately control the rate of speech
and to control the segmenting of speech acts so that there is con-
tinuous phonation and airflow between and within words. Continu-
ous phonation with normal rate and prosody become the goals for
room. Monitored speech is emphasized and the new speaking
skills are transferred into the patient's entire talking day by mov-
ing up a situation hierarchy. Unmonitored speech eventually replaces
monitored speech (Shames and Florance 1980).

The following alterations were made to Shames and Florance's
1980 original 'stutter-free' speech programme:

- The desired parameter of fluency was exchanged with that
  of efficient voice.
- The passive airflow technique, described by Schwartz (1976)
  was used to assist S. in initiating phonation.

The rationale for, and nature of the treatment programme was ex-
plained to S., and both reading and speaking were practised at vary-
ing rates of speech. A home programme was included as an adjunct
to the therapy programme.

Post-INTERVENTION MEASURES

Over the two days immediately after the therapy programme, both
subjective and objective evaluations were carried out following the
identical procedures to that of the pre-intervention evaluation.

RESULTS

Interater reliability was high for all measures (93-100%). The over-
all severity of the voice and the samples corresponding to the
fiberoptic slides were discussed until some agreement was reached.
SUBJECTIVE EVALUATION

a) QUALITATIVE ANALYSIS AND OVERALL VOCAL SEVERITY:

Table 1 indicates a summary of the results obtained for all three voice samples pre- and post-therapeutically.

Table 1 Mean ratings from the pre- and post-therapy qualitative analysis of 10 vocal parameters rated on a 7 pt. equal interval rating scale with 1 = Normal and 7 = Deviant, as well as overall severity of the vocal pattern.

<table>
<thead>
<tr>
<th>Vocal Parameter</th>
<th>/i:/</th>
<th>Reading</th>
<th>30 Sec. Spontaneous Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
</tr>
<tr>
<td>1) Laryngeal Tension</td>
<td>6</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2) Laryngeal Tone Rough/Grainy</td>
<td>4</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>3) Voice Tension</td>
<td>6</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4) Intermittent Strain-Strangle</td>
<td>3</td>
<td>1</td>
<td>5.5</td>
</tr>
<tr>
<td>5) Constant Strain-Strangle</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6) Loudness</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7) Pitch</td>
<td>5</td>
<td>3.5</td>
<td>2.5</td>
</tr>
<tr>
<td>8) Pitch Breaks</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>9) Rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) Overall Vocal Efficiency</td>
<td>4.5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Overall Severity</td>
<td>moderate</td>
<td>mild</td>
<td>severe</td>
</tr>
</tbody>
</table>

Table 2 Pre- and post-therapeutic frequency count of strained syllables (%SSS); total number of syllables and rate of speech in SPM for reading and spontaneous speech.

<table>
<thead>
<tr>
<th>Waveform Category</th>
<th>Pre</th>
<th>Post</th>
<th>Pre</th>
<th>Post</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Variability per phonation stretch</td>
<td>13%</td>
<td>4.3%</td>
<td>70.3%</td>
<td>71.4%</td>
<td>72.1%</td>
<td>64%</td>
</tr>
<tr>
<td>B) Shape of Lx:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Double/multi peaked base</td>
<td>16.8%</td>
<td>22.2%</td>
<td>14.2%</td>
<td>16%</td>
<td>26%</td>
<td>32%</td>
</tr>
<tr>
<td>ii) Irregular rise</td>
<td>0%</td>
<td>1%</td>
<td>3.7%</td>
<td>3%</td>
<td>2.8%</td>
<td>8%</td>
</tr>
<tr>
<td>iii) Double/multi peaked peak</td>
<td>18.8%</td>
<td>42.8%</td>
<td>25.7%</td>
<td>28%</td>
<td>40%</td>
<td>28%</td>
</tr>
<tr>
<td>iv) Irregular decline</td>
<td>0%</td>
<td>4%</td>
<td>36.6%</td>
<td>33.5%</td>
<td>40%</td>
<td>28%</td>
</tr>
<tr>
<td>v) Exaggerated gradual decline</td>
<td>0%</td>
<td>0%</td>
<td>36.6%</td>
<td>33.5%</td>
<td>40%</td>
<td>28%</td>
</tr>
<tr>
<td>vi) Sustained amplitude reduction</td>
<td>43.5%</td>
<td>43.5%</td>
<td>31.7%</td>
<td>34.2%</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>C) Shimmer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Jitter</td>
<td>0%</td>
<td>0%</td>
<td>27.7%</td>
<td>26.1%</td>
<td>28%</td>
<td>25%</td>
</tr>
<tr>
<td>ii) Abnormal Fx drops</td>
<td>0%</td>
<td>0%</td>
<td>27.7%</td>
<td>26.1%</td>
<td>28%</td>
<td>25%</td>
</tr>
<tr>
<td>D) Fx</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Jitter</td>
<td>0%</td>
<td>0%</td>
<td>22.7%</td>
<td>23.8%</td>
<td>17.1%</td>
<td>24%</td>
</tr>
<tr>
<td>ii) Abnormal Fx drops</td>
<td>0%</td>
<td>0%</td>
<td>22.7%</td>
<td>23.8%</td>
<td>17.1%</td>
<td>24%</td>
</tr>
<tr>
<td>E) Vocal Fry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 indicates a reduction in %SS and rate of speech (spm) for reading and speech samples.

OBJECTIVE EVALUATIONS

a) LARYNGOGRAPHIC ANALYSIS:

A summary of the results for the prolonged /i:/, reading and spontaneous speech samples on each category of the laryngograph is presented in Table 3. A frequency count for each type of waveform per phonation stretch is expressed in terms of a percentage.
The most noticeable change for all three voice samples can be seen in the amplitude of the wave forms. Table 4 indicates the change in average amplitude pre- and post-therapeutically.

Table 4 Changes in average amplitude of waveforms pre- and post-therapeutically.

<table>
<thead>
<tr>
<th></th>
<th>Prolonged /i:/</th>
<th>Reading Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Average Amplitude in mm.</td>
<td>10mm</td>
<td>25mm</td>
</tr>
</tbody>
</table>

b) FIBEROPTIC EXAMINATION:

Normal, symmetrical vocal folds were evident at rest and during deep breathing pre- and post-therapeutically. Both the true and false vocal folds remained abducted. Figures 1a and b indicate the physiological alteration of the vocal folds for the prolonged vowel pre- and post-therapeutically.

Figure 1a & 1b. The physiological alteration of the vocal folds during the prolonged /i:/ pre- (a) and post- (b) therapeutically.

Figure 1a reveals that pre-therapeutically the vocal folds were tightly adducted with the false folds approximating one another in an asymmetrical fashion. The left fold was tensed, had more bulk and was more adducted than the right fold. Figure 1b shows that post-therapeutically the true cords were not tightly adducted and a chink was visible along their inner border. The false folds approximated but were symmetrical. On subjective evaluation, the vowel in Fig. 1a was perceived as having a tight, strained hoarse quality, while in Fig. 1b, it was perceived as having a breaking quality.

Figures 2a & 2b. The vocal folds during the production of the word /zdwl/ pre and post therapeutically respectively.

Figures 2a and b reveal an alteration in the physiology of the vocal folds for spontaneous speech pre- and post-therapeutically. In Fig. 2a pre-therapeutically, total arrest of the glottis was apparent, where the false folds were tightly adducted in the midline, and obscured the view of the true vocal folds. Tension was evident posteriorly as adjustments in the arytenoid cartilages were made. Subjectively, a tight squeezed, laryngealized quality was evident. Post-therapeutically, less tension in the glottis was present. The true cords were not tightly adducted and a visible chink was present between the cords. While the false folds approximated they did not adduct. This was perceived as having a laryngealized quality on subjective evaluation.

Finally, Table 5 summarises the results obtained from both the subjective and objective evaluations after the therapy period.

Table 5 Overall summary of pre- and post-therapeutic measures for all three voice samples.

<table>
<thead>
<tr>
<th></th>
<th>Subjective Evaluation</th>
<th>Laryngograph Tracings</th>
<th>Fiberoptic Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Spontaneous speech</td>
<td>++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Prolonged /i:/</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
</tbody>
</table>

Key: + = slight improvement
++ = improvement

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DISCUSSION

The results of the study indicated some improvements on all three voice samples for both subjective and objective measures post-therapeutically. The improvement was most evident in a reduction in exaggerated gradual decline and increase in wave form amplitude on the laryngographic tracings as well as in strained phonation and overall vocal tension. Subjectively, the voice was judged as less tense, and a reduction in %SS was evident on the reading and speech samples. The reduction in exaggerated gradual decline and increase in wave form amplitude on the laryngographic tracings seemed to induce voluntary control over the adductor laryngeal muscles which facilitated the coordination of the muscles for phonation. Sustained phonation and easy initiation of phonation were found to eliminate the tight adduction in the cords and the effortful forced phonation in this study.

Lerman (1980) found that in spastic dysphonia, the overadducted vocal folds impeded the airflow, thus disrupting the delicate balance between airflow and glottic resistance which is necessary to produce acoustic phonation. The reduced rate of speech inherent in this therapy programme seemed to induce voluntary control over the adductor laryngeal muscles which facilitated the coordination of the muscles for phonation. Sustained phonation and easy initiation of phonation were found to eliminate the tight adduction in the cords and the effortful forced phonation in this study.

Adams (1975) and Schwartz (1976) feel prolonged speech facilitates glottal vibration by integrating sub-glottal air pressure, glottal resistance, supraglottal pressure, correct timing, smooth initiation and maintenance of airflow. Stuttering occurred when this integration was disturbed. This imbalance was observed in the present study which further lends support to the similarity in vocal fold physiology of stuttering and spastic dysphonia, and to the applicability of a 'fluency based' programme with an adductor spastic dysphonia client. The study also showed that behaviour therapy can be applied to consciously manipulate vocal cord behaviour, thus supporting the views held by Boone (1977), and Mower and Case (1982).

A rough laryngeal tone was still noted on the post-therapy subjective evaluation for reading and spontaneous speech. This was confirmed by the laryngographic tracings and the presence of false fold approximation on the fiberoptics examination. Boone (1977) writes that a rough vocal quality is caused by aperiodic vibration, and ventricular phonation may be caused by the ventricular folds lying in close contact with the superior surfaces of the true cords. Traill (1984) feels that the interference of the false folds above alters their tension and interferes with their movement. These perceptual characteristics showed up as irregular Lx waveforms on the laryngographic tracings, where shimmer, jitter and irregular peaks and declines were still noted post-therapeutically. Wechsler (1977) found that shimmer, jitter and irregular fold vibration could occur in normal speakers but Horii (1980) found these features were more extensive in pathological speakers. The high percentage of the above three features on the laryngographs of this subject, indicated some pathology to the subject's symptomatology confirmed the findings of Aronson et al. (1980). Regression after treatment might occur and therefore the need for longer treatment to maintain fluency in stutterers has been found to be essential with stutterers (Shames and Florance 1980). Regression after treatment might occur and therefore the need for longer treatment to maintain fluency in stutterers has been emphasized (Perkins et al. 1974; Shames and Florance 1980). Wechsler (1977) found that in voice disorders, when the larynx appeared to have improved, but no improvement on Lx waveforms was noted, further treatment and long-term follow-up was indicated lest relapse occurred. The findings of this study lend support to Wechsler (1977) since improvement was evident subjectively, but little change was determined on the laryngographic waveforms. Boone (1977) feels that long-term follow-up procedures are essential in spastic dysphonia which has such a high rate of symptom relapse.

The phase of follow-up included in the stutter-free speech programme has been found to be essential with stutterers (Shames and Florance 1980). Regression after treatment might occur and therefore the need for longer treatment to maintain fluency in stutterers has been emphasized (Perkins et al. 1974; Shames and Florance 1980). Wechsler (1977) found that in voice disorders, when the larynx appeared to have improved, but no improvement on Lx waveforms was noted, further treatment and long-term follow-up was indicated lest relapse occurred. The findings of this study lend support to Wechsler (1977) since improvement was evident subjectively, but little change was determined on the laryngographic waveforms. Boone (1977) feels that long-term follow-up procedures are essential in spastic dysphonia which has such a high rate of symptom relapse.

CONCLUSION

A 'fluency-based' therapy programme conventionally used for stutterers was found to be effective in altering the vocal behaviours of
a spastic dysphonic client. The writers feel that the therapy resulted in a reduction of vocal fold hyperadduction. This is in agreement with Perkins (1971) as cited by Reid (1980) stating that regardless of etiology, therapy for spastic dysphonia could be based on a functional analysis of vocal fold behaviour, where the knowledge of laryngeal function is used to achieve a more efficient voice.

ACKNOWLEDGEMENTS

The writers wish to thank Prof. A. Traill, Department of Linguistics, University of the Witwatersrand, Johannesburg, for his assistance, guidance and time in conducting the objective measures.

REFERENCES


Shames, G.H. and Fiorance, C.L. Stutter-Free Speech. Charles E. Merrill, Columbus, Ohio, 1980.


APPENDIX 1

READING AND SPONTANEOUS SPEECH SCALE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>normal</th>
<th>1 2 3 4 5 6 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Laryngeal Tension</td>
<td>1 2 3 4 5 6 7</td>
<td>extremely tense</td>
</tr>
<tr>
<td>2) Laryngeal Tone</td>
<td>1 2 3 4 5 6 7</td>
<td>exceptionally harsh/high</td>
</tr>
<tr>
<td>3) Turner in central speech</td>
<td>none</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>4) Voice Stoppages</td>
<td>none</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>5) Intersyllabic Strain-Stress</td>
<td>none</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>6) Constancy of Strain-Stress</td>
<td>none</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>7) Loudness</td>
<td>none</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>8) Pitch</td>
<td>none</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>9) Vocal inflections</td>
<td>none</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>10) Pitch breaks to higher pitches</td>
<td>none</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>11) Rate</td>
<td>none</td>
<td>1 2 3 4 5 6 7</td>
</tr>
</tbody>
</table>
| 12) Overall vocal efficiency | none | 1 2 3 4 5 6 7 | exceptionally 
| 13) Naturalness | none | 1 2 3 4 5 6 7 | unnatural |

APPENDIX 2

Summary of categories analyzed on laryngographic analysis adapted from Boone (1977), Horii (1980) and Traill (1984).

<table>
<thead>
<tr>
<th>Lx waveform</th>
<th>provides information on vocal fold vibratory cycle.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Regularity</td>
<td>maintenance of a stable vibratory pattern.</td>
</tr>
<tr>
<td>b) Waveform</td>
<td>provides a basis for observing the nature of contact and separation time of the vocal folds.</td>
</tr>
<tr>
<td>c) Shimmer</td>
<td>changes in adjacent wave amplitudes.</td>
</tr>
<tr>
<td>Fx waveform</td>
<td>vocal pitch.</td>
</tr>
<tr>
<td>a) Jitter</td>
<td>cycle to cycle variations in frequency. Cor-</td>
</tr>
<tr>
<td>b) Abnormal Fx drops</td>
<td>responds with shimmer in Lx. Shimmer and jitter</td>
</tr>
<tr>
<td></td>
<td>correlate with rough/hoarse voice.</td>
</tr>
<tr>
<td></td>
<td>exaggerated drops in Fx tracing.</td>
</tr>
</tbody>
</table>
