Efficacy of Prolonged Speech Therapy in Persons with Stuttering: Perceptual Measures

[1]Santosh.M. & [2]Savithri.S.R.

Abstract

Over centuries clinicians and researchers have offered different approaches to stuttering treatment. Among these prolonged speech has yielded the greatest effectiveness and appeared to be the strongest treatment in both the long- and short-term evaluations. However several concerns have been expressed with respect to type of outcome measures used and post-therapy unnaturalness sounding speech. The aim was to investigate the efficacy of prolonged speech therapy in persons with stuttering. Thirty persons with stuttering participated in the present study. A 300-word standard reading passage in Kannada, spontaneous speech/conversation was recorded before, after, and 6-month after prolonged speech therapy. Percent dysfluency, rate of reading and mean naturalness scores (MNS) were measured. Results indicated significant reduction in percent dysfluency and increase in MNS was noticed in the post therapy condition. However, percent dysfluency increased significantly in 6-month post therapy condition.

Key words: Dysfluency, prolonged speech, stuttering

Over centuries clinicians and researchers have offered different approaches to stuttering treatment (Bloodstein, 1995). Available treatment approaches differ not only in terms of the goals they seek to achieve, but also in the specific strategies used to achieve them. These treatments for stuttering can be divided into two broad categories of procedures. The first category contains treatment procedures that do not intentionally alter a stutterer's entire speech pattern. Typical of these treatments are those that are only response contingent arrangements to modify stuttering frequency. The second category contains treatments that deliberately alter the persons with stuttering overall speech pattern in order to reduce stuttering. This category includes a wide variety of treatments that induce persons with stuttering to use an unusual manner of speaking, which may then be systematically shaped (by some means) into relatively normal sounding speech. Typical example of latter type includes rhythmic speech and ***prolonged speech*** and its variants. These treatment procedures incorporate the use of a novel speech pattern to replace stuttered speech. Both the category of treatment programs in general involves the instatement, shaping, generalization, and maintenance of fluent prolonged speech.

Any treatment should include not only the quantification of the treatment targets but also a systematic evaluation of relevant behaviors. However, formal evaluations of the results of the stuttering therapies have not been carried out very often and long-term effects of these therapies have not been documented well. Studies examining the effects of stuttering therapy outcome for adults have been reviewed by Bloodstein (1995) has concluded that 'substantial improvement, as defined in these studies, typically occurs as result of almost any kind of therapy in about 60 to 80% of the cases. Andrews, Guitar, & Howie (1980) in their meta-analysis of different treatment procedures for stuttering reported that prolonged speech, gentle onset, rhythm, airflow, attitude change, and desensitization were the six most common principal treatment formats. Both prolonged speech and gentle onset yielded the greatest effectiveness and appeared to be the strongest treatments in both the long- and short-term evaluations.

Although currently prolonged speech is the most prominent among treatment procedures, several important concerns have been raised about its efficacy. First, in most the reports the type of outcome measures used are perceptual in nature, and second regarding unnaturalness sounding post therapeutic speech (Runyan, Bell & Prosek, 1990; Onslow,

[1]Assistant Professor, Department of Speech & Hearing, Manipal College of Allied Health Sciences, Manipal, Karnataka-576104.santosh.m@manipal.edu, [2]Professor & Head, Department of Speech-Language Sciences, AIISH, Mysore savithri_2k@yahoo.com

Costa, Andrews, Harrison, & Packman, 1996; O'Brian, Onslow, Cream & Packman, 2003). Subramanian (1997) and Kanchan (1997), investigated speech naturalness rating of adult persons with stuttering who underwent nonprogrammed prolonged speech therapy. Their results showed significant increase in mean naturalness score from pre-therapy to post-therapy condition. So, findings on the change in naturalness scores after therapy have emerged as an effective tool in investigating the efficacy of therapy but discrepancies exist with respect to reported findings. Therefore, a comprehensive study on efficacy of prolongation therapy in adult persons with stuttering with perceptual measures is needed. In this context, the present study was planned. The objectives of the present study were multifold and were as follows:

- To find the efficacy of nonprogrammed prolonged speech technique in persons with stuttering (PWS),
- to find the long-term effects of nonprogrammed prolonged speech technique in persons with stuttering (PWS), and
- to find out the correlation between perceptual parameters.

Method

Subjects: Thirty persons with stuttering participated in the study. The subjects' age ranged from 15- 38 years with a mean age of 20 years. All the participants were native speakers of Kannada and were diagnosed by qualified speech-language pathologist. None of them reportedly had any other speech, neurological, hearing or any other speech/language disorders. All the subjects had gradual onset of stuttering in childhood and reported normal speech and language development. None of them had any family history of stuttering. All the subjects were right-handed. Stuttering Severity Instrument (SSI) (Riley, 1980) was administered to assess the severity of stuttering. Based on SSI, stuttering in 11 participants was mild, moderate in 8 participants, and severe in 11 participants. But irrespective of severity, all participants were enrolled in prolongation therapy. Three subjects were females and the remaining 27 subjects were males. Out of 30 participants 27 participants had not attended any form of speech therapy. Three participants had attended modified airflow therapy earlier. However, two years had lapsed between the last therapy and the present evaluation and these participants did not further follow the therapy after completion of therapy at a clinic.

Clinical program: All participants completed a 3-week non-programmed prolongation therapy. Each therapy session was for 45 minutes and consisted of the following steps:

Step 1: Prolongation of all the syllables in subjects with severe stuttering.
Prolongation of initial syllable of the word in subjects with mild and moderate stuttering.

Step 2: Prolongation of the initial syllable of the word when stuttered or when anticipated to have stuttering - Experimenter monitoring.

Step 3: Prolongation of initial syllable of the word when stuttered or anticipated to have stuttering – Self - monitoring.

Step 4: Generalization with experimenter's support.

Step 5: Generalization without experimenter's support.

Step 6: Follow up after six months.

The criterion to move from one step to another was 95% fluency. In addition to therapy at the clinic, the subject practiced for four sessions of 30 minutes in a day. Subjects were terminated from therapy when they had achieved 95% fluency as assessed by a trained speech pathologist. Subjects' written consent was obtained before starting the program.

Material: A 300-word standard reading passage in Kannada, spontaneous speech/conversation served as the material. The experimenter developed the standard reading passage. It incorporated all the phonemes in Kannada with their respective frequency of occurrence as given by Jayaram (1985). Experimenter made a set of questions about the client's family, job, education, and hobbies to elicit spontaneous speech /conversation. Each speech sample, on an average, was of 10 minutes duration.

Procedure: Subjects were tested individually in a sound treated room. Subjects' reading, spontaneous speech and conversation were audio-recorded on to an audiocassette of the professional stereo cassette deck (Sony TC FX 770) using the microphone (Legend HD 800) kept at a distance of 10 cm from the mouth of the subject. The recordings were done prior to the start of therapy, soon after the termination of therapy, and 6 months after termination of therapy. Care was taken to ensure that the spontaneous speech and conversation were on the same topic on all the three recordings. A multiple test design was used.

Analysis: The recorded reading and speech samples were transcribed verbatim using IPA format and the following measures were calculated.

(1) Percent dysfluency

$$\text{Percent dysfluency in reading} = \frac{\text{Total number of dysfluent words in reading}}{\text{Total number of words read}} \times 100$$

$$\text{Percent dysfluency in speech} = \frac{\text{Total number of dysfluent words in speech}}{\text{Total number of utterances}} \times 100$$

(2) Type of dysfluencies: Types of dysfluencies were identified as per Bloodstein (1995) criteria as follows:

(a) *Repetitions*

- Syllable repetitions: Dysfluencies characterized by repetition of syllables (for example ba ba ba: ll).
- Part word repetitions: Dysfluencies characterized by repetition of part of a word (for example sne: ha sne: ha sne: hita).
- Whole word repetitions: Dysfluencies characterized by repetition of whole words (for example ball – ball).
- Phrase repetitions: Dysfluencies characterized by repetition of two or more words.

(b) *Unfilled pauses:* Silence longer than 300 ms.
(c) *Filled pauses:* Pauses with extraneous sounds such as /a/, /m/ etc.
(d) *Prolongations:* Dysfluencies characterized by prolonging a sound (for example naaaandi).
(e) *Interjections:* Dysfluencies characterized by addition of functional words such as the, well etc.

(3) Rate of reading: Subject's reading samples were transferred onto the computer memory. All the dysfluencies pauses longer 300 ms were truncated using COOLEDIT software. The syllables per minute (SPM) were calculated using following formula.

$$\text{SPM} = \frac{\textbf{Total number of syllables read}}{\textbf{Total time in seconds}} \times \textbf{60}$$

(4) Speech naturalness

Material: One minute stutter-free spontaneous speech and reading samples in all the three recordings (i.e. pre-therapy, post-therapy and 6-month post-therapy) were identified. Two trained speech pathologists identified samples that were stutter free. Only those samples that were identified by both the judges as stutter free were used for further

purpose. Samples were randomized and rerecorded on to two tapes, one containing speech sample and the other reading sample. In addition, 10% of the samples were also recorded on to the tapes for reliability measurement. Each tape contained a total of 99 samples (30 each of pre-therapy, post-therapy and 6-month post-therapy and 9 randomized samples). A number preceded each sample. A 30- second silence interval was inserted between two samples. Thus, a total of 198 samples formed the material.

Subjects: Ten naive listeners (5 males and 5 females) in the age range of 18-20 years served as judges. All the judges were native speakers of Kannada and literates in Kannada and English. They were first year undergraduate students of speech and hearing who were not trained in the evaluation of fluency.

Procedure: Subjects were tested individually. They were provided with a response sheet indicating speech naturalness scale. The naturalness scale included naturalness in reading and speech contexts. Subjects were instructed to listen to the audio-presented sample and carefully rate the naturalness of the sample on a binary scale, '1' representing natural and '0' representing unnatural (Kanchan, 1997). All the subjects had to rate 198 samples and they were instructed to stop the task when they felt fatigued. They could listen to samples as many times as required and each subject rated the sample over a week.

Analysis: Subject's ratings were tabulated separately and were grouped under pre-therapy, post-therapy and 6-month post-therapy samples of reading and spontaneous speech tasks. The naturalness ratings given by each judge for all the three recordings were converted to percentage naturalness rating for each subject and mean naturalness score was calculated using the following formulae.

$$\text{Naturalness rating for each subject} = \frac{\text{No. of judges rating a sample as natural}}{\text{Total no. of judges}} \times 100$$

$$\text{Mean naturalness score} = \frac{\text{Sum of naturalness ratings of all subjects}}{\text{No. of subjects}}$$

Intra and Inter judge reliability: The experimenter measured 10% of the samples again (random selection) after 6 months of the first measure, for intra-judge reliability. An experienced speech pathologist, unaware of the purpose of the study, measured percent dysfluency (for both reading and speech) and rate of reading (measured in SPM), in 10% of the samples (random selection) for inter-judge reliability.

Statistical analysis: The analyzed data were tabulated for each subject in three different conditions (pre-therapy, post-therapy and after 6months post-therapy) and subjected to the statistical analysis. SPSS (Version 10) was used for the statistical analysis. Means and standard deviations were calculated. Repeated measures ANOVA was done to find the significant difference between conditions. Pearson's product moment correlation was used to find correlation between parameters.

Results

1. **Percent dysfluency:** Repeated measures ANOVA showed significant difference between conditions [Reading- $F(2, 58) = 26.999$, $p < 0.05$, Speech- $F(2, 58) = 36.882$; $p < 0.05$ respectively]. Results of the Bonferroni multiple comparisons showed significant difference across all three conditions ($p < 0.05$) in both the tasks. Percent dysfluency

significantly reduced in post- and 6-month post-therapy conditions compared to pre-therapy conditions. However, percent dysfluency was significantly higher in 6-month post-therapy condition compared to post-therapy condition. Also, percent dysfluency in speech was higher compared to that in reading. Table 1 shows percent dysfluency in 3 conditions and two tasks.

Conditions/tasks	Reading		Speech	
	Mean	SD	Mean	SD
Pre-therapy	25.40	21.08	25.75	19.78
Post-therapy	1.65	2.03	1.83	2.95
6-month post-therapy	7.03	13.99	6.14	9.58

Table 1: Mean and SD of percent dysfluency in three conditions and two tasks

2. Type of dysfluencies: The types of dysfluencies included syllable repetition, part-word repetition, word repetition, filled and unfilled pauses, interjections, omissions, and prolongations, in the pre-therapy reading and speech samples. Syllable repetition, part word repetition, word repetition, filled and unfilled pauses were observed in post-therapy and 6-month post-therapy reading and speech samples. In addition, prolongations were observed in 6-month post-therapy reading and speech samples. Among the different types of dysfluencies, syllable repetitions were the most common and prolongations were the least common. Also, more number of subjects had dysfluencies in reading task than in speech task (except for filled pauses in pre-therapy and post-therapy conditions). Table 2 shows percentage of subjects exhibiting each type of dysfluency across conditions.

Type of dysfluency	Task	Condition		
		Pre	Post	6post
Syllable repetition	Reading	100	56.66	90
	Speech	83.33	23.33	60
Part word repetition	Reading	80	53.33	60
	Speech	36.66	10	16.66
Word repetition	Reading	36.66	26.66	23.33
	Speech	13.33	6.66	16.55
Filled pauses	Reading	50	26.66	46.66
	Speech	70	30	36.66
Unfilled pauses	Reading	43.33	20	30
	Speech	36.66	3.33	0
Prolongations	Reading	26.66	3.33	16.66
	Speech	16.66	0	13.33

Table 2: Percentage of subjects exhibiting each type of dysfluency across conditions

3. Rate of reading - Syllables per minute (SPM): Results revealed significant reduction in mean SPM in post-therapy condition compared to that in pre-therapy condition. However, there was significant increase in mean SPM in 6-month post-therapy condition compared to that in the pre-therapy condition. ANOVA showed significant difference between conditions [$F(2, 58) = 4.191$; $P < 0.05$]. Results of the Bonferroni multiple comparisons showed significant difference between post-therapy and 6-month post-therapy conditions ($p<0.05$). Table 3 shows mean and standard deviation of SPM in all three conditions.

.

Conditions	Mean	SD
Pre-therapy	306	70
Post-therapy	290	54
6-month post-therapy	316	47

Table 3: Mean and SD values of SPM in three conditions

Intra and inter judge reliability: The results of the reliability index showed high intra- and inter judge reliability ($\alpha = 0.9$) on percent dysfluency and rate of reading.

4. **Mean naturalness score:** Repeated measures ANOVA revealed significant difference between conditions [Reading- F (2, 58) = 15.153; P < 0.05, Speech- F (2, 58) = 17.927; p < 0.05]. Mean naturalness score was higher in post-therapy condition compared to that in pre-therapy and 6-month post-therapy conditions. Bonferroni multiple comparisons showed significant difference (p<0.05) between pre-therapy and post-therapy conditions, and pre- therapy and 6-month post-therapy conditions in both the tasks. Table 4 shows mean naturalness scores in three conditions and two tasks.

.

	Reading		Speech	
Conditions/ tasks	Mean	SD	Mean	SD
Pre-therapy	41.00	38.35	50.33	39.17
Post-therapy	77.00	30.18	89.33	18.92
6-month post-therapy	69.33	36.47	80.66	32.37

Table 4: Mean naturalness scores in three conditions and two tasks

Intra and Inter judge reliability: Reliability index showed significant high intra and inter judge reliability (α = 0.9).

Correlation: Results of Pearson's product moment correlation showed significant (p< 0.05) positive correlation between, percent speech and reading in pre-therapy condition, 6-month post-therapy percent dysfluency and 6-month post-therapy SPM in speech and reading tasks and MNS in two tasks in 6-month post-therapy condition. Significant negative correlation (p< 0.05) was found between MNS and percent dysfluency in pre and post-therapy conditions, SPM and mean naturalness score in post-therapy (reading) and 6-month post-therapy conditions.

Discussion

The results of the study revealed several points of interest. First**,** mean percent dysfluency decreased significantly from pre-therapy to post-therapy condition in both tasks. The results confirm the findings that prolonged speech treatment has clear and positive effects on speech of persons with stuttering. The results, in particular, are in line with the findings of Onslow, Costa, Andrews, Harrison & Packman (1996) who also that the non-programmed version of prolonged speech is effective in reducing dysfluency. However, percent dysfluency increased significantly from post-therapy condition to 6-month post-therapy condition in both tasks indicating that prolonged speech technique was not so effective in maintaining fluency over long–term at least in some subjects. This result, in particular, is not in agreement with previous reports of Onslow et. al. (1996) who reported long-term maintenance of fluency in persons with stuttering. The reason for the difference in results could be attributed to maintenance phase. Onslow et. al. included maintenance phase in which subjects had regular weekly follow-ups, and their speech was assessed. Such weekly maintenance phase was not adopted in the present study. However, subjects were followed monthly, but no audio-recordings were made. The results suggest a need for regular follow-up to maintain fluency.

Second, results indicated that certain types of dysfluencies persisted in post- and 6-month post-therapy condition. Till date no report is available on this aspect. This result indicated reduction in frequency, but not in types of dysfluencies in post-therapy speech.

Third, rate of reading (SPM) decreased from pre-therapy to post-therapy condition and increased significantly from post-therapy to 6-month post-therapy condition. The results do not support the previous findings of O'Brian et. al. (2003). This can be attributed to the difference in rate measurements. In the present study, dysfluencies, and pauses longer than 300 ms were eliminated in rate measurement while O'Brian et. al. (2003) did not. Onslow et al (1996) highlighted the importance of eliminating dysfluencies. He opined that the presence of stuttering episodes might decrease the rate; i.e., more severe the stuttering slower the rate and therefore, it is necessary to remove dysfluencies and measure rate with fluent words. The increase in rate from post- to 6-month post-therapy condition indicates that, the post-

therapeutically achieved reduction in rate of speech is not maintained in the long-term. This could be the possible reason for the increase in the percent dysfluency in the 6-month post-therapy condition.

Fourth, mean naturalness score (MNS) increased significantly from pre-therapy to post-therapy condition. The results support the findings of Kanchan (1997), and Subramanian (1997), and partially support the findings of Onslow et. al. (1996). Kanchan (1997) and Subramanian (1997) reported significant improvement in MNS, while Onslow et.al. (1996) reported no post-treatment regression in MNS in PWS who underwent nonprogrammed prolonged speech treatment. However, the results are not in consonance with those of Runyan, Bell & Prosek (1990). The reasons for the discrepancy in results are two fold. First, in the present study stutter-free samples were used and second, nonprogrammed prolonged speech technique was used. It appears that nonprogrammed prolonged speech technique leads to more natural sounding post-therapy speech compared to programmed prolonged speech technique in which rate is controlled.

Finally, a negative correlation between percent dysfluency and SPM, percent dysfluency and MNS and a positive correlation between SPM and MNS was observed. This is expected as MNS improves with increase in SPM.

Conclusion

The results of the present study indicated that percent dysfluency, type of dysfluency, rate and MNS can be used as perceptual measures to test the efficacy of stuttering therapy. In the present study speech and reading samples of persons with stuttering were recorded before, after and 6-months after post-therapy. Significant reduction in percent dysfluency, increase in MNS was noticed after therapy. However, percent dysfluency increased significantly in 6-month post therapy condition. Although perceptual measures have been widely used to assess the efficacy, they have been criticized for their superficiality. As an answer, ***acoustic analysis*** have been found to be informative because it affords quantitative analysis that carry potential for subsystem (respiratory, laryngeal, and articulatory) description and for determining the correlates of perceptual judgment. Further studies are needed with complementary acoustic measures which can highlight on the individual subsystem errors in these patients.

References

Andrews, G., Guitar, B. & Howie, P. (1980). Meta-analysis of the effects of stuttering treatment. *Journal of Speech and Hearing Disorders*, *45,* 287-307.

Bloodstein, O. (1995). *A handbook on stuttering.* (5th Ed). San Diego, CA: Singular Publishing Group.

Jayaram.M. (1985). Sound and syllable distribution in written Kannada and their application to speech and Hearing. *Journal of All India Institute of Speech and Hearing*, *16*, 19-30.

Kanchan. S. (1997). Multi dimensional speech naturalness scale for stutterers. . In M. Jayaram & S. R. Savithri (Eds.). *Research at AIISH: Dissertation Abstracts: Vol. IV*. pp 1, 2003.

O'Brian, S., Onslow, M., Cream, A. & Packman, A. (2003). The Camper down program: outcomes of a new prolonged-speech treatment model. *Journal of Speech and Hearing Research*, *46*, 933-946.

Onslow, M., Costa. L., Andrews, C., Harrison. E. & Packman, A. (1996). Speech outcome of a prolonged speech treatment for stuttering. *Journal of Speech and Hearing Research*, *39*, 734-739.

Runyan, C. M., Bell, J. N., & Prosek, R. A. (1990). Speech naturalness ratings of treated stutterers. *Journal of Speech and Hearing Disorders*, *55*, 434-438.

Subramanian, A. (1997). Naturalness ratings of stutterers' speech. . In M. Jayaram & Savithri, S.R(Eds.). *Research at AIISH: Dissertation Abstracts: Vol. IV*. pp 1, 2003.