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Innovation of Speech Hand Synchronization as a Treatment in Adults who Stutter

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Abstract

Objective: Stuttering is a complex communication and developmental speech disorder wherein forward flow of speech is interrupted by sound repetitions, words, prolongation of sounds and psychological and social effects. Most of the therapeutic approaches may focus more on cognitive, behavioral or psychological therapy. The aim of this study was to innovate the novel stuttering therapy procedure and to evaluate its efficiency in adults who stutters in accomplishing spontaneous fluent speech.

Methods: The current proposal was designed as the pilot study and the participants were selected based on 3 treatment groups i.e., (i) speech-hand synchronization (SHS) (ii) Camperdown programme (CP) and (iii) control group CG). The equal number (n=10) of participants were selected in all the 3 groups and treatment sessions was carried out for 50 minutes per day for 10 weeks (5 days/week).

Results: The stuttering severity instrument-4 was used to measure the scores of pre and post treatment. The overall, assessment of the speakers' experience of stuttering, locus of control of behavior and speech satisfaction rating scale.

Conclusion: The results of the current study conclude non-significant alterations and huge similar outcomes within the SHS and CP groups. This could be due to difference in the superior programme between SHS and CP, in terms of fluency, participants quality of life and satisfaction and internal locus of control.

Keywords: Adults who stutter; Speech-Hand Synchronization; Person who stutters; Stuttering; Camperdown programme; Treatment; Hand movement

Introduction

Stuttering is a multifactorial communication disorder that interrupts the forward flow of

Speech production and in phonological working memory may be one of the factors that contribute to the difficulties in persons who stutter have establishing and maintaining fluent speech, particularly when presented with cognitively demanding tasks [1]. The growth in the stuttering appears during the initial school i.e. between 2-4 years and stuttering can be quite variable, especially in childhood. It is quite varying between the children and in adults may be due to the difference in the speaking context [2]. Person who stutter (PWS) may find variability discouraging because they do not always know when a moment of stuttering will occur. They are given false hope when they experience moments of increased fluency and are disheartened when they are more disfluent [3].

The theoretical background to the new stuttering therapy procedure which is called speech hand synchronization (SHS). This approach combines speech restructuring and cognitive approaches. It is a combination of fluency shaping constructs with non-speech motor gestures to help adults who stutters (AWS) achieve spontaneous fluent speech. This study also focuses to determine the effectiveness of this therapy in terms of fluency, improve quality of life of participants, internal locus of control and participants satisfaction. The SHS approach combines approaches from various different disciplines: speech and language pathology, neurology, psychology and self-improvement strategy, and a number of different therapeutic initiatives are implicated, namely Fluency Shaping (FS) [4], Gesture [5,6], Cognitive and Coping [7-9], Habits [10,11], Self-evaluation and problem-solving [12]. The SHS approach is a Saudi Arabian programme developed in 2005 at King Abdul-Aziz Medical City National Guard Hospital in Riyadh city. The SHS approach was initially tested with school-age individuals who stuttered, 1 year of therapy managed to reduce their overall stuttering [13]. The uniqueness of this approach lies in synchronization of hand movements (HM) with non-speech motor gestures, thus facilitating the learning of a new and improved fluency of speech.

The creation and development of the Camperdown programme (CP) was notably not encouraged through a causal theory [14,15], but rather following an assessment of a sound empirical study; thus, as such studies continue to be conducted, the CP and its corresponding manual will be updated and amended so as to take into consideration any newly drawn conclusions. Furthermore, a number of different publications also report directly on the CP [16], who deliver data surrounding the development and rationale of the programme. A number of efficacy trials have been published surrounding the treatment, such as Phase-I, Phase-II Phase-III and clinical trials development [14,15,17,18], considering medium-to long-term follow-

ups, randomised controlled trials, social validity data, and clinical trials of the treatment, the latter of which adopts a tele-health format [19]; notably, the delivery of the treatment through this particular medium provides results not dissimilar to those of in-person formats, but are ultimately considered to be more convenient and efficient [17,20].

The CP programme comprises four different stages:

- Individual teaching sessions stage,
- A group practice day stage,
- Individual problem-solving sessions stage, and
- Performance-contingent maintenance stage (PCMS)

Hypotheses

Hypothesis 1: SHS group will show significantly reduced stuttering at immediate post clinic assessments compared to the controls and CP groups as evidenced by stuttering severity instrument-4 (SSI-4) raw scores.

Hypothesis 2: The SHS group will significantly improve the affective, behavioral, and cognitive reaction to stuttering, reduce functional communication difficulties, and reduce the effects of stuttering on the participants' overall quality of life as measured by the Overall Assessment of the Speaker's Experience of Stuttering (OASES) compared to controls and CP group at immediate post clinic.

Hypothesis 3: The SHS group will show significantly increased internality as measured by Locus of Control of Behavior (LCB) compared to controls and CP group at immediate post clinic assessments.

Hypothesis 4: The SHS group will show significantly improved speech related self-perceptions and significantly reduced impact of the stuttering on daily living as evidenced by Speech Satisfaction Rating Scale (SSRS) compared to controls and CP group at immediate post clinic assessments.

Methods

This is a pilot study carried out in King Abdul-Aziz Medical City National Guard Hospital, capital city of Saudi Arabia between 30 Saudi nationalize adults. The inclusion criteria of the participants were (i) PWS, (ii) they must have illustrated and reported the onset of stuttering prior to being six years of age, (iii) there should be no recognized issues in regard to motor development, (iv) there should be no report of concurrent issues in regard to language- or speech-development, (v) the participant must not be taking any medication recognized as potentially affecting articulation, depression, phonation or respiration, (vi) there should be no recognized psychiatric problems, or have any recognized reported VII nerve, or hearing impairments, diagnosed epilepsy or neurological issues (vii) participants must be adults and fall into the 18-50 age group, (viii) participants must have been diagnosed with persistent developmental stuttering, (ix) the participants should be willing to attend all treatment sessions, (x) the participants should be located within the City of Riyadh (xi) all participants must have a minimum of secondary-school qualifications (xii) the participants must be native speakers of Arabic, and (xiii) the participants must not have undergone any form of therapy during the previous 12-month period. Depending on the inclusion and exclusion criteria, the participants were selected randomly with the case history which comprises the history, family history of stuttering, previous therapy, and any medical or psychological information. The participants were alienated into 3 treatment groups i.e., (i) SHS (ii) CP and (iii) control group CG). The equal number (n=10) of participants were selected in all the 3 groups and treatment sessions was carried out for 50 minutes per day for 10 weeks (5 days/week) described in Table 1. The participants were treated in a clinic environment on a one-to-one basis with a clinician (2 sessions per week in the first 6 weeks and one session per week thereafter). Each participant undergoes 50 minutes per session for 16 sessions/times, including increasing fluent speech by adopting new three paradigms: (i) focusing on the success (fluent speech) rather than focusing on treating the problem (stuttering/PWS), and (ii) applying gestures (example; HM synchronized with PS) and (iii) controlling the rate of speech via discrete steps. Aiming to evaluate change across behavioral and cognitive dimensions a range of assessments were applied. They are namely SSI-4, OASES, LCB and SSRS while self-perceptions of speech were assessed utilizing the TEFCAS (trials, events, feedback, check, adjust, success) approach to understand the meta-cognition of learning. The procedure simply requires the respondent to give a score in terms of general speech satisfaction. All assessment materials were translated into Arabic and the translation checked by independent back translation to English for accuracy and reliability [21]. The translation is easy to understand and uses an educational standard of secondary school. These measurements take about 1 hour in total to complete.

Stuttering severity instrument (SSI)

The SSI-4 tool seeks to quantify duration, frequency and physical concomitants of dysfluency amongst children of pre-school age through to adults. The measure is particularly oriented towards both non-readers and readers, and delivers behavioral severity levels, spanning very mild, mild, moderate and severe. despite there being a large range of fluency tools available, this one is most highly recommended owing to its all-encompassing utilization, as well as the overall reliability in regard to administration procedures.

Overall assessment of the speaker's experience of stuttering (OASES)

The OASES measure is an all-encompassing tool that considers the stuttering disorder as a whole within the context of the international classification of functioning, disability and health model, which can be utilized during the course of daily treatments, and also in regard to therapy results. This particular tool comprises four different segments, namely General Information, Reactions to PWS, Communication in Daily Situations, and Quality of Life. Obviously, throughout the course of this research, ratings will be reported associated with each section and the overall impact stuttering perceived in regard to the individual's life.

The locus of control (LOC)

The LOC considers the degree to which participants hold the belief that they have the capacity to monitor and regulate their own behaviors. This measure reflects the considered 'externality' of control, with higher scores illustrating greater perception in this regard [22]. Obviously, the LCBS is assigned prior to the initiation of treatment as well as following therapy. In this regard, it has been found that, of those participants that decrease their locus of control scores by more than 5% from pre-treatment through to post-treatment, there is a greater likelihood that relapse will occur [21].

Week Number	Session Number	Session Duration	Status	No of syllable (s)/ word (s)/ seconds
1	1	50 minutes	Preparation Stage	Prolong one syllable + HM in 5 seconds
	2	50 minutes		Prolong none-sense-word + HM in 5 seconds
2	3	50 minutes	Action Stage	Prolong one syllable word + HM in 5 seconds
	4	50 minutes		Prolong two syllables word + HM in 8 seconds
3	5	50 minutes	Action Stage	Prolong three syllables word + HM in 9 seconds
	6	50 minutes		Prolong three syllables word + HM in 9 seconds
4	7	50 minutes	Action Stage	Prolong four syllables word + HM in 8 seconds
	8	50 minutes		Prolong 2 words + HM in 8 seconds
5	9	50 minutes	Action Stage	Prolong 2 words + HM in 8 seconds
	10	50 minutes		Prolong 3 words + HM in 6 seconds
6	11	50 minutes	Action Stage	Prolong as many words as the participant can + HM (one second for one word)
	12	50 minutes		Prolong as many words as the participant can +no HM (0ne second for one word)
7	13	50 minutes	Maintenance stage	Prolong as many words as the participant can +no HM (0ne second for one word)
8	14	50 minutes	Maintenance stage	Prolong as many words as the participant can +no HM (0ne second for one word)
9	15	50 minutes	Transfer stage	Prolong as many words as the participant can +no HM (0ne second for one word)
10	16	50 minutes	Transfer stage	Prolong as many words as the participant can +no HM (0ne second for one word)

Table 1: PS-HM synchronization technique.

Speech satisfaction rating scale (SSRS)

Participants are evaluated in relation to their overall speech satisfaction. This is achieved through the implementation of a self-rating scale, utilizing 11 points, with 10=the best judgment and 0=the worst judgment [23]. This scale is recognized as adhering to the Dutch grading system; 1=very bad and 11=excellent. The investigator asked the participants to give a score in terms of general speech satisfaction. Accordingly, the score was given in consideration to various elements of stuttering, such as negative emotional and cognitive reactions, reactions of listeners, and stuttering severity. Moreover, this scale considers more deeply that symptom status is impacted by intra-individual characteristics.

The researcher distributed the forms during the first interview with the participants. He was available if there were any problems but the participants filled in the forms themselves. The forms were collected by the researcher at the end of the interview. All of the subjects from the three different groups (SHS, CP & CG) gave speech samples, which involved conversation (300 syllables) with the audio device positioned approximately 30 to 40 centimeters from the participants and a reading task (200 syllables), which were recorded using a Sony IC Recorder (ICD-AX412F). Speech samples were taken from an audiotape recorded within the clinic environment, each totaling approximately 3 minutes [24], were independently assessed blindly by two trained raters [25] through for both frequency of stuttering (%SS) and the number of syllables, review of the speech performed using a qualified speech-language pathologist. Sound prolongations, blocks (silent prolongation of an articulatory posture), in addition, syllable and sound repetitions were recognized as stuttered syllables. Any instances of repeated monosyllabic words, with any degree of clear unwarranted tension or stress, were also considered in this regard. The duration of the three longest blocks and the observations of the physical concomitants were incorporated for the prediction of stuttering severity amongst adult subjects that stutter.

Statistical analysis

Using SPSS software version (19.0) statistical analysis was performed. The values were calculated as mean ± standard deviation. ANOVA analysis was carried out to compare the 3 different groups. P value less than 0.05 were considered as statistical significant.

Results

The current study consists of 30 subjects divided into 3 groups as described earlier in this study. The participants were selected between the 18-50 years of age. The results of 4 hypotheses have been explained in detailed.

Hypothesis 1: The mean and difference in mean scores between the pre and immediate post treatments for SHS, CP and CG have been described. The pre-post treatment results showed significant differences between participants who received either SHS or CP compared to CG. However, no significant differences were detected between SHS and CP. Immediate post-treatment ANOVA comparison tests also showed no difference between SHS and CP, but both SHS and CP produced significant difference when compared with CG (Table 2).

Groups	N	Pre		Post		Difference: Mean Pre – Mean	P value on Difference
		Mean	Std Dev	Mean	Std Dev		
SHS	10	34	3.36	18.8	4.05	15.2	<0.001
CP	10	32.4	4.93	22	3.16	10.4	<0.001
CG	10	33.3	3.92	32.7	3.5	0.6	0.239

Table 2: Descriptive and repeated measures ANOVA for pre- and post-treatment using SSI-4. Where, SHS-Speech-Hand Synchronization group; CP-Camperdown Programme group; CG-control group; Std Dev-Standard deviation.

Hypothesis 2: This specific part addresses the differences between SHS, CP and CG in relation to improving the quality of life for people suffering from stuttering. Using the OASES tool, the repeated measures results demonstrate significant differences between the pre and post SHS treatments. Significant differences were also found between the participants between SHS and CG groups. The results further exposed significant differences between CP and CG groups. The study results established no significant differences between the SHS and CP groups. Immediate post-treatment ANOVA results also showed no difference between SHS and CP, but significant differences between SHS or CP with CG (Table 3).

Groups	N	Pre		Post		Difference: Mean Pre – Mean	P value on Difference
		Mean	Std Dev	Mean	Std Dev		
SHS	10	60.07	4.91	45.08	6.99	14.99	<0.001
CP	10	55.10	9.50	41.83	13.96	13.27	<0.001
CG	10	59.60	5.12	58.59	4.93	1.01	0.315

Table 3: Descriptive and repeated measures ANOVA for pre- and post-treatment using OASES. Where, SHS-Speech-Hand Synchronization group; CP-Camperdown Programme group; CG-control group; Std Dev-Standard deviation, OASES-Overall Assessment of the Speaker's Experience of Stuttering.

Hypothesis 3: This part has been formulated in order to examine the differences between the SHS and CP groups in comparison with the CG using LCB measurement. This study results demonstrate significant differences between the SHS and CG on the post-treatment level. The results also found significant differences between the CP and the CG. Both SHS and CP groups performed better than CG at both statistical and clinical significance. However, the results showed no significant differences between the SHS and CP groups. Immediate post treatment ANOVA results also showed no difference between SHS and CP, but significant differences between SHS or CP against CG (Table 4).

Groups	N	Pre		Post		Difference: Mean Pre – Mean	P value on Difference
		Mean	Std Dev	Mean	Std Dev		
SHS	10	50.00	5.87	40.80	5.94	9.20	<0.001
CP	10	51.10	5.65	41.50	4.50	9.6	<0.001
CG	10	48.80	5.99	49.30	5.48	-0.50	0.315

Table 4: Descriptive and repeated measures ANOVA for pre- and post-treatment using LCB.

Hypothesis 4: This part mainly focused on improving the individuals' self-perceptions and the reduction of stuttering problems using the SSRS measurement. This hypothesis examines the differences between the groups participating in the study and receiving SHS and CP treatments. The results of this study showed significant statistical differences between pre and immediate post treatment, whether for participants who received SHS treatment or for those receiving CP. Using the SSRS tool for measuring the effectiveness of the treatment, the results showed that both SHS and CP had significantly and clinically important effects on how satisfied the participants were with their progress in improving fluency at the post clinic. In addition, there were no statistical or clinically important differences between SHS and CP. That is, both programs produced the same effect with regards to improving individuals' self-perception and reducing stuttering. Immediate post-treatment ANOVA results showed no difference between SHS and CP, but differences were detected between SHS or CP against CG (Table 5).

Groups	N	Pre		Post		Difference: Mean Pre-Mean	P value on Difference
		Mean	Std Dev	Mean	Std Dev		
SHS	10	2.3	1.06	8.4	0.52	-6.1	<0.001
CP	10	2.7	0.95	8.4	0.07	-5.7	<0.001
CG	10	2.7	0.67	2.2	0.63	0.5	<0.01

Table 5: Descriptive and repeated measures ANOVA for pre- and post-treatment using SSRS.

Discussion

Stuttering is also more pronounced when an individual is rushed or in a stressful speaking situation. In fact, one of the few invariant aspects of stuttering is that it is highly variable [2]. The results with cognitive/behavioral theory confirm the participants' speech has been restructured and has managed stuttering through fluency. The data of this study displayed no significant difference between SHS and CP, a deeper exploration of the raw data seems to reflect the superiority of SHS over CP. Table 6 confirms the raw data for SSI-4. The focused pre-test data of SHS and CP has 3 cases of very severe stuttering and 5 cases of severe, while CP has only 1 case of very severe stutter and 6 cases of severe stutter. However, SHS has 2 cases of moderate stuttering, while CP has 3. So on average, SHS has a higher quantity of severe PWS than CP. If both programs are equal, we expect each to have equal step/category changes, indicating what was expected to see more cases in the milder category of CP than SHS. However, when i look at immediate post-treatment, the results reveal a pattern which is virtually the reverse of what i was expecting. SHS has converted these cases to 4 in very mild stuttering, while CP only has 1. Mild cases are 4 for SHS, compared to 6 for CP. For moderate cases, SHS has only 2, while CP has 3. This indicates CP now has more cases in the more severe categories. It is quite clear that SHS has a bigger step or category change towards milder categories compared to CP.

Test	Severity	SHS	CP	CG
	Very Mild	0	0	0
	Mild	0	0	0
	Moderate	2	3	3
	Severe	5	6	4
Pre	Very severe	3	1	3
	Very Mild	4	1	0
	Mild	4	6	0
	Moderate	2	3	3
	Severe	0	0	4
Post	Very severe	0	0	3

Table 6: The number of participants of SHS, CP and CG raw data using SSI-4 instrument

SHS has its core to use of hand synchronization gestures with PS, while CP uses only PS. Most of the speech language pathologists have considered the use of hand gesture is a sign of secondary behavior and consideration in favor of hand movement is when one uses a hand movement in the SHS, one does so consciously, and one is therefore able to differentiate when and where one should stop moving the hand. As presented earlier, the SHS total sessions is 16 (50 minutes each) conducted using the technique of prolonged speech-hand movement, 11 of them used hand movement. SHS achieves spontaneous controlled speech in 16 sessions in a 10-week period, while CP needs more than 10 weeks, with periods of up to two or more years being cited by its developers. SHS is therefore able to produce similar outcomes but with fewer sessions, making it quicker and less expensive and this confirms the SHS could be the one of the best optional program. The results of this study confirm the additional weightage for reducing the frequency of PWS and improve the fluency of speech [26].

There was no significant difference between the SHS and CP when compared with the scores and deeper exploration of the raw data seems to indicate superiority of SHS over CP. The data in Table 7 indicated the pre-test in CP had milder cases. For example, CP did not have any participants' in the severe category, whereas the SHS has 7 participants.

Test	Severity	SHS	CP	CG
	Mild	0	0	0
	Mild-to-moderate	0	2	0
	Moderate	3	5	3
	Moderate-to-severe	0	3	7
Pre	Severe	7	0	0
	Mild	1	3	0
	Mild-to-moderate	3	2	0
	Moderate	6	3	5
	Moderate-to-severe	0	2	5
Post	Severe	0	0	0

Table 7: The number of participants of SHS, CP and CG using the OASES Instrument

The immediate post treatment results showed complete different outcome. The chief category of impact severity for SHS is moderate, which indicates 7 severe participants were had an entire category i.e. moderate to severe and for CP, the most severe category of impact

severity was still moderate to severe. In case of CP, out of the 3 participants who were initially in moderate to severe category only 1 participants improved by 1 category. However, other 2 participants were not improving. Among 5 participants, initially the moderate category, only 2 participants have improved, whereas, remaining 3 has the minimum of 1 category with no improvement. Therefore, a persuasive argument to claim that SHS might be better than CP when the OASES instrument is used.

The results of this current study find high external LCB at pre-test. The interpretation was participants feels to reduce control among their emotions, behaviors and actions of others and the internal LCB scores are high in indicative of existence of unknown factors, whose impact on PWS is negative, significant and includes anxiety, fear, acceptance and even stress. This study results also displayed that participants learned through feedback by checking frequently and implementing required changes with modifications and participants' responded to TEFCAS principles, which are centered in the concept of motivation.

The current results demonstrate PWS lost control on their own progress which indicates few participants' were not involved in practicing the task regularly at home and majorly, the participants' were focused on the process of treatment as opposed of outcome, and they have also spent more effort in training themselves. This indicates participants have established a clear picture about PWS and what to accomplish and discover. The pain and concept of pleasure acceptance of others, self-motivation and taking responsibility have been adopted by the participants. The present study was in agreement with the earlier studies [27-30] indicating the changes in locus of control have also been reported as predicting the maintenance of therapeutic gains or the relapse in stuttering therapy. These findings also collaborate with Blomgren et al. [31], who carried out similar study in 29 participants and examined the treatment outcome of stuttering. The purpose of the test was to measure the satisfaction of the participants with the progress of their speech. The fact that there was a significant and clinically meaningful increase in satisfaction that means the participants were happy with their progress, indicating that the success of the program and results conclude that SHS and CP programs are equally effective in increasing the satisfaction of speech. The current limitation of our study was low sample size and lack of incorporating the ages for all the participants.

Future Scope of the study

This session can be adapted for individuals of 15 years old. Future studies should be implemented with clinical trials required to conduct with participants earlier than 15 years of age in order to find out if this may be implemented in the young children (<15 years) in order to understand the process of SHS, a protocol will be developed for the future use of clinicians in speech. This study suggests to follow up the study in future with the similar participants to evaluate for long term effects of SHS in future.

Conclusion

The results of the current study conclude the non-significant alterations and huge similar outcomes within the SHS and CP groups. This could be due to difference in the superior programme between SHS and CP, in terms of fluency, participants quality of life and satisfaction and internal locus of control.

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