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Speech Remediation of a Long-Term Stutter: A Case Study

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Abstract

Background: This research article describes the remediation of stuttering in an adult participant with a long-term history of drug abuse. The unique participant in this case underwent this successful treatment at an urban residential rehabilitation mission where he was living in lieu of incarceration.

Methods: The therapeutic intervention in this case consisted of two programs. The primary intervention involved the Ryan Fluency Program, Gradual Increase in Length and Complexity of Utterance (GILCU), which is a step-based program that requires the participant to progress from the production of a single, fluent word to 10 minutes of conversation in the absence of overt disfluencies. Based on the particular needs of this participant, the primary investigator incorporated the use of delayed auditory feedback in an effort to demonstrate to the participant that fluent speech was possible.

Results: As seen in tables and as discussed in the article, the participant initially produced 16 stuttered words per minute in the Fluency Interview and this number was reduced to .06 stuttered words per minute five months later. Additionally, the participant spoke at an average of 130.0 WS/M, which falls into the average rate based on norms established by Ryan (150.9, with range of 119-182.6). At nine months post-assessment, the participant was demonstrating smooth, forward-flowing, speech, free of overt disfluencies, with appropriate rate.

Conclusion: This case study adds credence to the growing body of evidence supporting fluency shaping, behaviorally based programs to remediate overt stuttering. Further, this study, which used delayed auditory feedback in conjunction with GILCU, demonstrates the appropriateness of designing therapeutic interventions based on the specific needs of each participant. Finally, this case study validates the in depth knowledge of experienced clinicians as a significant factor in the decision making process for selecting and implementing interventions.

Background

In 2012, McMicken and Vento-Wilson reported a case history of an adult male with a long-term developmental stutter who resided in a drug and alcohol rehabilitation mission within a large urban environment [1]. This case was subsequently reported in Yairi and Seery in 2014 [2]. A brief summary of the 2012 case is presented here for the convenience of the reader.

The participant, TF, had been formally sentenced for a history of felonies and current narcotic sales and use. As a third strike felon, the participant was given the choice to go to prison or to complete a rehabilitation program; the participant chose the rehabilitation program in an urban-based mission. In addition to adhering to the rigorous requirements of the rehabilitative program, the participant made the decision to address his lifelong stutter that had previously been resistant to remediation. With the help of the first author, the Primary Investigator (PI), the participant's stuttering was targeted successfully through the use of a modified version of the Ryan Fluency Program (RFP), which is an fluency shaping approach based on operant conditioning principles. The modifications to the established protocols included the initial use of pause time, which was utilized to

help the participant stop and speak fluently in advance of a stuttered utterance. At present, 4.5 years post-initiation of treatment, this participant has self-reported the continued presence of speech that is free of overt disfluencies. Further, based on recent observations by the PI he continues to demonstrate overtly smooth, forward-flowing, natural sounding speech across his work environment, family interaction, and daily life.

Due to the successful application of this program in the setting described above, Speech-Language Pathology (SLP) services have continued to be offered to participants of the mission, and as such, an additional opportunity arose to report on the remediation of another long-term stutterer.

Introduction

Stuttering, which is said to affect approximately 1% of the adult population [3-5], is a complex and multidimensional speech disorder whose impact crosses into an individual's social, cognitive, emotional, and physiological life [5]. Research suggests that the etiology of stuttering has been linked to both genetic and environmental factors involving speech, motor, language, and psychosocial aspects [5]. Stuttering manifests itself in an individual's speech as interruptions in the forward flowing of speech. These interruptions can take the form of sound, syllable, and one-word repetitions, sound prolongations, or

stoppages of airflow or voicing in speech. Individuals who stutter can also exhibit secondary behaviors that may develop as learned reactions in response to the core stuttering behaviors [4]. These behaviors can include visible tension in speech mechanisms or the face, respiratory anomalies, and abnormal movements [5]. In addition to these physical manifestations there can be negative feelings and attitudes that develop as a result [4].

Evidence-based, behaviorally-based therapeutic approaches to this disorder include stuttering management, which strives for speech that may be disfluent, but is free of obvious effort, struggle, or tension, and fluency-shaping, which strives for the elimination or reduction of stuttered speech [4-7]. One example of an evidence-based intervention based on fluency shaping is Gradual Increase in Length and Complexity of Utterance (GILCU) [8,9]. GILCU is a step-based intervention that progresses from 1-word responses up through 5 minutes of reading, monologue, and conversational tasks in the absence of overt stutters; it consists of three phases (i.e., establishment, transfer, maintenance) and employs verbal contingencies for stuttered and nonstuttered speech, which are "stop, speak fluently," and "good," respectively [6,10]. A detailed description of the program hierarchy is provided in the Figure 1.

Step number Stimulus	A Reading	B Monologue	C Conversation	R Recycle
1 "Read/say one word fluently"	Reads 1 word, 10 consecutive 0 SWs	Says 1 word, 10 consecutive 0 SWs	Says 1 word, 10 consecutive 0 SWs	Reads/says 1 word, once at 0 SWs
2 "Read/say two words fluently"	Reads 2 words, 10 consecutive 0 SWs	Says 2 words, 10 consecutive 0 SWs	Says 2 words, 10 consecutive 0 SWs	Reads/says 2 words, once at 0 SWs
3 "Read/say three words fluently"	Reads 3 words, 10 consecutive 0 SWs	Says 3 words, 10 consecutive 0 SWs	Says 3 words, 10 consecutive 0 SWs	Reads/says 3 words, once at 0 SWs
4 "Read/say four words fluently"	Reads 4 words, 10 consecutive 0 SWs	Says 4 words, 10 consecutive 0 SWs	Says 4 words, 10 consecutive 0 SWs	Reads/says 4 words, once at 0 SWs
5 "Read/say five words fluently"	Reads 5 words, 10 consecutive 0 SWs	Says 5 words, 10 consecutive 0 SWs	Says 5 words, 10 consecutive 0 SWs	Reads/says 5 words, once at 0 SWs
6 "Read/say six words fluently"	Reads 6 words, 10 consecutive 0 SWs	Says 6 words, 10 consecutive 0 SWs	Says 6 words, 10 consecutive 0 SWs	Reads/says 6 words, once at 0 SWs
7 "Read/say one sentence fluently"	Reads 1 sentence, 5 consecutive 0 SWs	Says 1 sentence, 5 consecutive 0 SWs	Says 1 sentence, 5 consecutive 0 SWs	Reads/says 1 sentence, once
8 "Read/say two sentences fluently"	Reads 2 sentences, 5 consecutive 0 SWs	Says 2 sentences, 5 consecutive 0 SWs	Says 2 sentences, 5 consecutive 0 SWs	Reads/says 2 sentences, once
9 "Read/say three sentences fluently"	Reads 3 sentences, 5 consecutive 0 SWs	Says 3 sentences, 5 consecutive 0 SWs	Says 3 sentences, 5 consecutive 0 SWs	Reads/says 3 sentences, once
10 "Read/say four sentences fluently"	Reads 4 sentences, 5 consecutive 0 SWs	Says 4 sentences, 5 consecutive 0 SWs	Says 4 sentences, 5 consecutive 0 SWs	Reads/says 4 sentences, once
11 "Read/talk fluently for ½ min"	Reads aloud ½ min at 0 SWs	Talks in monologue ½ min at 0 SWs	Converses ½ min at 0 SWs	Read/monologue/conversation, ½ min at 0 SWs
12 "Read/talk fluently for 1 min"	Reads aloud 1 min at 0 SWs	Talks in monologue 1 min at 0 SWs	Converses 1 min at 0 SWs	Read/monologue/conversation, 1 min at 0 SWs
13 "Read/talk fluently for 1½ min"	Reads aloud 1½ min at 0 SWs	Talks in monologue 1½ min at 0 SWs	Converses 1½ min at 0 SWs	Read/monologue/conversation, 1 min at 0 SWs
14 "Read/talk fluently for 2 min"	Reads aloud 2 min at 0 SWs	Talks in monologue 2 min at 0 SWs	Converses 2 min at 0 SWs	Read/monologue/conversation, 2 min at 0 SWs
15 "Read/talk fluently for 2½ min"	Reads aloud 2½ min at 0 SWs	Talks in monologue 2½ min at 0 SWs	Converses 2½ min at 0 SWs	Read/monologue/conversation, 2 min at 0 SWs
16 "Read/talk fluently for 3 min"	Reads aloud 3 min at 0 SWs	Talks in monologue 3 min at 0 SWs	Converses 3 min at 0 SWs	Read/monologue/conversation, 3 min at 0 SWs
17 "Read/talk fluently for 4 min"	Reads aloud 4 min at 0 SWs	Talks in monologue 4 min at 0 SWs	Converses 4 min at 0 SWs	Read/monologue/conversation, 3 min at 0 SWs
18 "Read/talk fluently for 5 min"	Reads aloud 5 min at 0 SWs	Talks in monologue 5 min at 0 SWs	Converses 5 min at 0 SWs	Read/monologue/conversation, 5 min at 0 SWs
Criterion Test (CT) <0.5 SWs/M—next >0.5 SWs/M—recycle	Reads aloud for 3 min	Talks in monologue for 3 min	Converses for 3 min	Redo CT
Review Read/talk 1 min fluently	Reads aloud 1 min at 0 SWs	Talks in monologue 1 min at 0 SWs	Converses 1 min at 0 SWs	

Figure 1: Gradual Increase in Length and Complexity of Utterance (GILCU) program.

An additional therapeutic approach involves the use of Altered Auditory Feedback (AAF) as a means of modifying the speaker's speech, and reducing stuttering frequency [11]. This altered speech signal can take the form of Masked Auditory Feedback (MAF), Frequency-Altered Feedback (FAF), or Delayed Auditory Feedback (DAF) [12], which can range from 50 to 250 milliseconds, based on the needs of the individual.

Purpose of the Present Study

As in McMicken and Vento-Wilson [1], the purpose of this current study was to accurately document the reduction of overt stuttering behaviors of a long-term male stutterer, and the subsequent continuous production of effective and efficient speech. The therapeutic intervention in the present study involved the combined use of a fluency-shaping behavioral approach (GILCU) and DAF, as a novel combination based on the unique needs of the participant. For this case study, as in the previous, effective speech was defined as speech that was natural sounding, free of overt disfluencies or obvious external controls, and, appearing spontaneous across settings and communication partners [7,13]. The use of the term "efficient" was added to describe and document appropriate rate of speech.

Methods

Participant

In 2013, the PI began treatment with a 38-year-old homeless male with a severe incipient stutterer, MC. This participant had been admitted to the 13-month program of a large urban rehabilitation mission for drug and alcohol abuse. As in the case of the previously reported participant, the current participant, MC, had been court ordered to go through rehabilitation or face a long-term incarceration. Personal history of the participant entailed growing up in South Africa, where he had received speech therapy, but reported that, "…it didn't help…," and being teased and bullied throughout high school. Shortly after graduation from high school, the participant immigrated illegally to the United States. While in the United States, he stated he had always had some kind of employment but had been addicted to cocaine, marijuana, and alcohol since the age of 12. Over the course of the past 10 years he had been charged with multiple misdemeanors, including Driving Under the Influence (DUI) and one felony assault; he spent brief periods in jail. Upon admission to the rehabilitative mission MC had illegal immigration status and was in jeopardy of incarceration as a result of not attending mandated court appearances. At initial intake by the mission, MC was referred to the PI of this study, a volunteer SLP of the mission, for speech assessment and treatment.

Speech and other assessment

MC was assessed and began treatment one week after starting the 13-month residential rehabilitation program. At that time, he had been through a detoxification process and had been clean and sober for ten days. The PI conducted all assessment measures with the participant: all assessment sessions were audio taped by special permission of the mission administration and recorded materials were stored on site. As in McMicken and Vento-Wilson [1], baseline fluency testing was accomplished using the revised Fluency Interview (FI) [14], with the addition of telephone speaking and the use of language appropriate for an adult. In addition to the FI, Criterion Tests (CTs) of 5 minutes each of reading, conversation, and monologue were administered at the completion of each phase of establishment, transfer and maintenance of skills.

Stuttering behavior was rated initially as severe across the tasks of reading, monologue, and conversation. The PI counted and documented Stuttered Words (SW) rather than syllables, based on the standard protocol of the RFP. Assessment results revealed the average SW per Minute (SW/M) during reading, conversation and monologue

to be 16.8 SW/M. Specifically, conversation was rated the most severe at 22 SW/M, monologue was 16 SW/M, and reading was 11 SW/M. Stuttering behaviors, which occurred most frequently upon the initiation of a sentence or phrase, consisted primarily of single and multiple part-word repetitions, with prolongations and struggle. Rapid rate of speech was noted to be present during all attempts at communication.

In addition to the stuttering behaviors described above, the PI noted that the participant demonstrated flapping of the upper extremities upon initiation of speech. Although the PI initially categorized this flapping as a secondary behavior, upon further analysis, consultation with the participant's treating physician, and the PI's previous experience with Extrapyramidal Movement Disorders (EMD) associated with cocaine abuse [15], it was determined that these movements were not secondary behaviors associated with stuttering, but were evidence of extrapyramidal movements related to the drug abuse.

As part of the initial assessment, the Erickson S-24 Scale [16] was used as a qualitative measure. This scale was used to document MC's perceptions about his pre- and post-treatment communication abilities. Higher scores on the 24-point scale indicate increased difficulty with and decreased perceptions of communicative competence. MC's score on the Erickson S-24 Scale was 20 out of 24, which indicated that MC had a prevalence of negative emotions or behaviors associated with stuttering. In addition, the participant was asked to assess his pre- and post-treatment speech naturalness, using a 9-point scale (1=highly natural speech, 9=highly unnatural speech) [17]. Initially, he rated his pre-treatment speech naturalness at a Level 9. These measures were repeated post-establishment and post-transfer.

Reliability

The PI's reliability for counting incidents of stuttering was established through extensive university training under the supervision of Dr. Bruce Ryan. Further, the PI has taught the RFP for many years and has demonstrated this reliability in published research [1,18]. All estimates of WPM and counting of SW were performed following the initial evaluation, FI, and CT sessions. The procedure consisted of counting total SW and total Words Spoken per Minute (WS/M), and dividing either of those numbers by the talking time of the participant to yield SW/M and WS per Minute (WS/M). The PI also noted topography (type) of stuttering, which were classified primarily as prolongations, and included part-word repetition and laryngeal block.

During treatment, the first author recorded each session and maintained detailed notes documenting the number of SW and WS during each session. MC was aware of and had given written permission for audio recordings. Recordings of assessment and treatment sessions were made in a sound treated room. Audio recordings of the participant's speech were made by the PI on a Sony digital 4GB UX Series Digital Voice Recorder with a frequency response of 50-20,000 Hz. These specifications were determined to be adequate to pick up the nuances of disfluencies. These recordings were later analyzed for WPM and SW/M.

Treatment

Speech

The twice-weekly treatment was provided in a large, sound treated room with secure privacy. In the initial treatment session the participant indicated he did not want to participate, but the mission had made it a requirement of his rehabilitative program. In interviews, MC indicated that he had underdone years of treatment in South Africa with no success and reported that he knew he could not stop stuttering. MC also stated that his treatment was primarily rhythm based and consisted of him tapping his finger when he said a word.

Following initial testing with the FI and CTs, a modification to the standard RFP was introduced as a technique to assist with confidence in the therapeutic process and the establishment of temporary fluency. This modification, Delayed Auditory Feedback (DAF) [19,20] was used in the initial 6 sessions. DAF was introduced as a means to demonstrate to the participant that stutter-free speech was possible. The DAF was initiated through the use of The Facilitator, (http://www.drboone.com/page2/page2.html) manufactured by KayPENTAX. In addition to the unique needs of the participant, DAF was selected based on the extensive training the PI received under Dr. William Perkins and her experience with it as one of the useful methods of training participants with fluency disorders for the past four decades.

The modified GILCU program began with reading, conversation, and monologue, using GILCU with the addition of DAF. Increments of delay were 250 ms, 200 ms, and 150 ms; the participant reported that he was most comfortable with a delay of 150 ms. Observation and data collection confirmed that this level was where the participant produced the most fluent speech. Within 6 sessions, the GILCU steps were completed in reading, conversation and monologue with the use of DAF. This procedure demonstrated to MC the possibility that he could improve his severe stuttering. However, without the DAF, stuttering occurred with the same average frequency prior to initiating its use. Due to the ongoing DAF controversy over the benefits [11], or lack thereof [21], it was decided to proceed with the standardized GILCU for the remainder of treatment. From the seventh session forward, formal treatment included only the standardized GILCU. Ongoing criterion for success of the procedures consisted of 0.0 SW/M during program steps and 0.5 SW/M or less during 5 min each of reading, conversation, and monologue in post treatment CTs. These processes were used for a total of 64 total therapy sessions. As with assessment sessions; therapeutic sessions were audio taped by special permission of the mission administration.

Following standard protocol, during the treatment portion of the program, the participant was told "good" by the clinician after each correct, fluent response, and "stop, speak fluently," if the responses were stuttered. At the program outset following 6 sessions of DAF, the PI strictly adhered to the RFP and stopped MC only when a SW was uttered. MC's reading selections were chosen from a religious text, as the mission was a religious program. Monologue topics involved discourse on specific elements of his life and their personal relevance. Conversation involved reflections on his drug abuse, illegal immigration status, and troubled past. MC's requisite parole hearings were used as part of his transfer activities as were telephone calls to pro bono attorneys regarding immigration status.

Psychosocial

Psychosocial counseling is offered to participants of the rehabilitation program at the mission through a contract with a nearby university for graduate students' externship placement. These externs are supervised at the mission by faculty from the university. Each individual in the drug and alcohol rehabilitation program receives weekly individual and group counseling sessions. This program has enhanced the adjustment of individuals to sober living and added an important component to the overall rehabilitation process. MC participates in these sessions and the PI has incorporated these sessions into transfer and maintenance phases.

Results

Following establishment of fluency techniques through initial use of DAF and then continued use of GILCU, there were few, if any, examples of stuttering. Nine months after initiation of treatment, there were typically a total of 4 SW during 50 minutes of talking time (4/50=0.08 SWs/M).

The results are shown in Tables 1 and 2.

	FI (SW/M)	CT (SW/M)	CT (WS/M)	
Date (Phase)	M	M	M	Hours
12/3/2013 Establishment	16	12	160.0	24
2/20/2014 Transfer	NA	0.06	123	24
5/20/2014 Maintenance	0.06	0.05	130	16
Total	NA	NA	NA	64

Table 1: Results of FI and CT (a) Pre-GILCU Establishment, (b) Post-Establishment Through Pre-Transfer, and (c) Post-Transfer for Client MC. Note: FI=Fluency Interview; CT=Criterion Tests; GILCU=Gradual Increase in the Length and Complexity of an Utterance; SW/M=Stuttered Words per Minute; WS/M=Words Spoken per Moment; NA=Not Applicable or not done.

	Speech Naturalness	Erickson S-24 Scale
	9 point scale	24 point scale
Pre-treatment	9	20
Post-treatment	2	4

Table 2: Results of Speech Naturalness Scale [17] and Erickson S-24 Scale [16].

Establishment

Total establishment hours for the three modalities of reading, monologue, and conversation were 24 hours over 3 months, with the participant seen twice a week for 60 min sessions. The establishment time spent with the DAF prior to formal GILCU treatment was included in these hours. The time required for the establishment phase was longer than the reported mean of 8.1 hours [22], which may reflect the stuttering severity and preconceived doubts the participant had for the potential of speech improvement. However, consistent improvement, which he was aware of, was demonstrated as measured by the FIs and CTs.

Transfer

The transfer program continued for the next 3 months, with the participant being seen 2 times a week in a variety of settings. A variety of locations and circumstances were incorporated into transfer activities based on research [23] supporting their importance in treatment as they have the potential to provide accurate indications of possible disfluent behavior. MC was seen for a total of 24 hours in transfer, which exceeded the reported mean indicated by Ryan of 11.7 hours [22]. This extended number of transfer hours reflects the commitment of the researcher, the commitment and motivation of the participant, and the multiple opportunities available for transfer activities in the mission community that went well beyond those described in the RFP and B. Ryan [22]. This increase in hours and activities was deemed necessary because the participant had been treated unsuccessfully in the past and appeared to benefit from the additional training. Treatment consisted of 1 to 10 segments of talking time in various settings and activities, such as making phone calls within the mission, giving directions, and using set questions to interview coworkers, other mission students, or his supervisors. The PI was able to incorporate many of the frequent unusual speaking situations from the mission into MC's transfer activities, such as reporting on work facility requests that were in limbo. All of MC's responsibilities within the mission were incorporated into transfer, including his use of overtly fluent speech during his counseling sessions.

The graduate student psychotherapists working with him were informed of the parameters of transfer and were cooperative. During transfer, MC's supervisor reported observation of occasional stuttering when MC was in stressful situations, such as when his work responsibilities required him to interact with other mission residents in an authoritarian position. Additionally, in parole hearings his stuttering was reported by his supervisor to be no more than a few isolated incidents, which he caught and corrected in conversation with the court offices. In clinical session no more than 1 to 2 SW/M were noted, with transfer sessions averaging of 0.05 SW/M. Overall, MC improved from an average of 16 SW/M to 0.05 in conversations on the FI and CTs.

During the transfer process, TF, the participant described in McMicken and Vento-Wilson, 2012, became a communication partner to MC and carried out two full sessions with MC [1]. TF and MC interacted through reading, conversation and monologue. During these sessions, TF was unable to identify an incident of stuttering. TF, MC, and the PI were on agreement in these findings.

Maintenance

At the time of this report, MC was being seen twice a week in observational maintenance and had completed 16 hours. As with both establishment and transfer, this therapeutic time is longer than the average reported 11.2 hours by B. Ryan [22]. MC was given extra time in maintenance due to the challenges he faced in the mission environment and his continuing work on his immigration status. MC has continued with the psychosocial counseling, with reports of no

stuttering in the individual and group settings. His speech, as reported by multiple observers, was free of overt disfluencies. MC has stated that he must concentrate to be fluent and that in the beginning he experienced fatigue after his speech sessions. He no longer reports fatigue, but has indicated it still takes concentration to be fluent. He recently spoke on speakerphone with his mother in South Africa. He did not stutter in this conversation, and she stated she was "astonished" by his "clear speech." His rate of speech is slower than average, but the rate does not appear unusual and is considered "natural" by MC. In a recent observation, MC was noted to speak at 165 WPM in monologue and 125 WPM in a reading task.

Other assessments

As discussed above, MC's pre-treatment speech naturalness was self-rated using the 9-point speech naturalness scale at a Level 9 (1=highly natural speech, 9=highly unnatural speech) [17]. Post-treatment and post-transfer naturalness were self-rated at a Level 2. According to Finn [23], research has validated the use of this scale to evaluate speech quality and to assist in treatment decisions. In addition, the participant's communication attitudes were self assessed pre-treatment with the Erickson S-24 Scale [16] at a level of 20. MC's Erickson S-24 Scale score post-transfer was 4, indicating improvement, in that his self-perception of his speech difficulty was minimal. Research has demonstrated that the range for stutterers on the Erickson S-24 to be 9 to 24, with a mean of 19.22, and for nonstutterers, the range is 1 through 21, with a mean of 9.14 [16].

Final observations

At the completion of transfer and when compared with normally fluent speakers, MC generally spoke in a slower manner as demonstrated in Table 1, with an average of 130.0 WS/M. According to Ryan [22], the mean of normal speakers is 150.9, with a range of 119-182.6. MC frequently stated that his fluent speech required him to focus. In a treatment interview recently with TF, MC explained that he was slowly getting used to how his new speech sounds and is produced and that it was beginning to feel more natural to him. According to multiple researchers [23,24], the participant's perception of the stuttering experience is a valid consideration in evaluating efficacy.

The maintenance program began six months post initiation of treatment on a twice-weekly basis, with the participant being observed in his work setting at the mission. He maintained a fluency log and reported twice monthly for 10 minutes over the phone on his fluency skills. He was given a CT on a monthly basis. At the time of this report, MC was preparing for graduation from the mission and preparing himself for work, which will involve taking auto mechanic courses at a local community college. The rehabilitative mission has supported MCs' continued efforts to work actively with a pro bono immigration attorney on his immigration status and with his parole officer on expunging his police record. MC has continued with a self-reported stuttering level of 3 or 4 incidences in 50 min of talking and a monthly CT of 0.05 SW/M in conversation, reading, and monologue. The primary change in speech MC used to alter his fluency proficiency was rate. He reported slowing his speech in stressful situations, which he encountered on a daily basis while living at the mission. He reported maintaining fluent, natural sounding, spontaneous speech across difficult settings and communication partners, but not without constant vigilance, findings that have been corroborated by research [25].

Discussion

As stated above, the primary purpose of this case study was to document the clinically significant reduction of overt disfluencies of a unique, long-term stutterer with multiple confounding factors. In addition to the presence of a severe stutter that had been resistant to previous therapy, the participant had a long history of drug and alcohol abuse, was living in a rehabilitation mission under a court order, and was experiencing significant personal stressors, including the recent achievement of sobriety, legal residency issues, and previous homelessness. A final obstacle to be overcome in this therapeutic endeavor was the participant's strongly held opinion that fluent speech was not possible. It was the combination of all of these factors that led the PI to use both the DAF, as a means of overcoming the participant's opinion about the possibility of fluent speech, and the behaviorally-based fluency-shaping intervention of GILCU, as a means of retraining the participant's speech mechanism to produce speech relatively free of overt disfluencies. This unusual combination of interventions, DAF and GILCU, was based on the clinical experience of the PI and the individual needs of the participant. Research has shown [26] that best clinical practices support the incorporation of well-researched interventions, clinical experience, and participant considerations when determining a course of therapeutic actions to achieve intervention goals.

The participant described in this case study has demonstrated that the attainment of effective and efficient speech relatively free of overt difluencies is possible, although this phenomenon is not frequently documented in the literature [27] and is not well understood [28]. The multifactorial nature of stuttering and the lack of consensus of a definition of the term recovery factor into the paucity of research on this issue. As discussed above, stuttering manifests itself in surface, observable behaviors (i.e., sound repetitions and sound prolongations, stoppages of airflow or voicing in speech), as well as deeper, covert behaviors (e.g., speaking avoidance, reduced participation) [29]. With these parameters in mind, what is the best definition of recovery from stuttering? Is it the complete elimination of overt disfluencies, or must it include a concomitant elimination of the covert mechanisms of stuttering? Or, alternatively, can the definition of recovery from stuttering be defined as a meaningful and observable significant reduction in overt disfluencies through the use of direct changes to speech, within a paradigm of "successful stuttering management," as described by Plexico, Manning, and DiLollo [25]? This concept of self-management of stuttering is of primary relevance to the participant discussed in this study. For MC, as well as others described in the literature [1,27,30], research supports the finding that speech that is natural sounding and free of overt disfluencies across multiple settings and communication partners may be achieved with behavioral changes to the manner of speaking and maintaining attention to multiple speech events [25]. In interviews, MC reported that his speech required him to focus, and the authors of this case study contend that it was the behavioral modifications to his speaking and his internal focus that were allowing the participant to produce speech that was natural sounding and essentially free of overt disfluencies across multiple settings and communication partners. In addition to these changes in the overt characteristics of stuttering, the participant's self-rating on the Erickson S-24 shifted from 20 pre-treatment to a 4 post-treatment. These findings support research [23] suggesting that overt changes in stuttering, as well as the participant's perspective on these changes are significant factors in ascertaining whether an intervention can be considered successful.

In addition to the influence of self-management of stuttering, further factors that have been identified as contributing to overall increases in overt fluency [1,25,27,31-33] include conscious practice of speech, direct changes in speech, motivation to change, and change in confidence. Additionally, internal motivation was implicated in late-term recovery of stuttering [32]. When asked recently what he attributed his new speech to, MC stated that first and foremost, the use of DAF had given him hope that change was possible. Continuing, he identified the method of stopping before he stuttered, which allowed him the necessary time to produce fluent speech. In addition to changes in his speech, MC experienced success in other areas of his life, which include attending a trade school for a future vocation and maintaining his sobriety. This parallel success has been validated by Plexico, Manning and DiLollo [25], who reported similar findings.

After successfully quelling MC's initial concerns about his ability to attain fluent speech, MC was highly motivated to make changes to his speech and demonstrate speech free of overt disfluencies. He achieved this goal through the use of the RFP and the addition of short-term DAF. However, due to the multiple factors involved in his rehabilitative experience (e.g., sobriety, psychosocial support, the overall group and rehabilitative experience), in addition to the novel use of a combination of therapeutic approaches, it is difficult to isolate a single primary factor in his recovery, which has been demonstrated across multipoint data collection, in multiple locations, and with multiple communication partners.

Components of successful fluency management are currently a source of debate [34]. Fluency-shaping therapy has been shown to be an effective and efficacious approach to stuttering [7]. However, researchers have recommended that further research be conducted to confirm the effectiveness of accepted theories [7] and to make continued advancements in evidence-based research [9,35,36]. Ultimately, what must be addressed when evaluating any intervention is the question: "does the treatment work as expected?" [37]. In the current study, the participant achieved speech, free of obvious struggle and had changed his impression of himself and was able to manage his disfluent moments with the skills acquired through the intervention.

Limitations

The present case study has inherent limitations in its limited scope, the unique application of a combined therapeutic intervention, and multiple confounding factors, and as such, cannot be applied broadly to the population of people who stutter. Although these limitations cannot be ignored, the successful remediation of long-term stuttering in this case replicates findings in the previous case study [1] and contributes to the gathering body of evidence for GILCU, DAF [38], and an individualized approach designed for a specific participant. Although, the participant in this study demonstrated speech, free of obvious disfluencies, there are additional limitations that must be considered when evaluating the effectiveness and efficacy of this therapeutic intervention and its potential application to the very heterogeneous population of people who stutter. The intervention selected for this participant was complex, with many working parts (i.e., DAF, GILCU), which makes it significantly more difficult to identify a single influencing factor that can be credited as being the agent of change in the frequency of overt disfluencies [39]. Further specific limitations of this study include the use of questionnaires on the participant's perspective on his fluency delivered by the PI and the lack of inclusion of naïve listeners for formal speech naturalness ratings. Finally, limitations are reflected in the inherent complexities of stuttering research because of the multidimensional factors that are not easily generalized to the heterogeneous population of people who stutter [39].

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