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Stuttering and other nonfluencies in adductor spasmodic dysphonia

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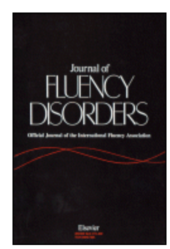
Abstract. The purpose of this paper was to compare the percentage of stuttered words, the percentage of disfluent words not typically described as stuttering, and the total of all disfluencies between 28 individuals diagnosed with adductor spasmodic dysphonia (ADSD) and 28 age- and sex-matched controls. ADSD participants were tested prior to Botox injections and following Botox injections which have been shown to improve speech characteristics in ADSD. No significant differences were found between groups for the percentage of stuttered words, the percentage of disfluent words not typically described as stuttering, nor the total of all disfluencies.

1. Background

According to Aronson and colleagues, adductor spasmodic dysphonia (ADSD) is a laryngeal disorder where the controlled movement patterns are interrupted by voice stoppages (Aronson, Brown, Litin, & Pearson, 1968). These stoppages are most common during connected speech that leave the speaker with a strained quality of voice that is often marked by breaks in the forward flow of speech. This results in a strained-strangled phonatory pattern. It has been difficult to perceptually describe these patterns, and they have been referred to as "disfluencies," "dysfluencies," "nonfluencies," and "stuttering." This is somewhat confusing in the literature. "Stuttering" or "dysfluency" are the speech behaviors related to childhood onset stuttering. These include part-word repetitions (d-d-d-d-d-dysphonia), single-syllable word repetitions (I-I-I-I hear that), prolongations (ssssssssssssssspasmodic) and blocks (………..[pause with no phonation] ………….dysphonia). These speaking behaviors have also been observed in adult onset/acquired stuttering (e.g., De Nil, Jokel, & Rochon, 2007). Other breakdowns in fluency, that are not stuttering, exist in the speaking patterns of most individual speakers. These include multi-syllable word repetitions (e.g., I wonder-wonder-wonder-wonder if I'll get better), phrase repetitions (I want to, I want to, I want to go to therapy), interjections (I want to go –um- outside), restarts/rephrases (I want to go….I would like to go outside), and other disfluencies that are not stuttering (Van Borsel & Tetnowski, 2007). These will be referred to as "other disfluencies" for the remainder of this manuscript. These "other disfluencies" are noted in most speakers and have also been noted in speakers following stroke, neurogenic disorders such as Tourette Syndrome, cluttering, and many other conditions. When considering both "stuttering" and "other disfluencies" together, the term, "total disfluencies" will be used throughout this paper.



The identification and description of these behaviors is confusing due to poor reliability between judges identifying stuttering and other disfluencies (Ingham, Cordes, & Finn, 1993; Ingham, Cordes, & Gow, 1993). Some researchers have shown that the only people capable of reliably determining where stuttering or some other type of fluency breakdown occurs is the actual speaker and only when identification is within close temporal proximity of when the speaker's fluency broke down (Moore & Perkins, 1990; Tetnowski & Schagen, 2001). Clearly, this is difficult enough to determine in people who stutter that do not have any other pathology. The task is considerably more difficult when other pathology, such as adductor spasmodic dysphonia exists.

2. Stuttering and adductor spasmodic dysphonia

Cannito, Burch, Watts, Rappold, Hood, and Sherrard (1997) investigated fluency breakdowns in people diagnosed with spasmodic dysphonia and compared them with matched controls (+/- 1 year) while reading The Rainbow Passage (Fairbanks, 1960). They found significant differences in the frequency of total disfluencies and speaking rate between adductor spasmodic dysphonia clients and normal controls. That study used a commonly-used taxonomy devised by Darley and Spreistersbach (1978) that defined all types of fluency breakdowns. However, that taxonomy is not consistent with more current differentiation of stuttering versus other forms of disfluency (e.g., Ham, 1989).

Although there is no known cure for ADSD, there are treatments that have shown promise in improving ADSD symptoms. Since the underlying mechanism behind the speech and voice differences in ADSD are hyperactive or spasms of the phonatory musculature, treatments such as Botulin toxin temporarily weaken these hyperactive muscles, limiting spasms and improving speech and voice. Research supports this view. Specifically, Botulin toxin has been shown to have a significant impact on the voice and speech characteristics in individuals with ADSD. Cannito, Woodson, Murray and Bender (2004) utilized two panels of expert judges with experience in voice quality or fluency during a reading of the Rainbow Passage. They found that treatment with Botox helped the perceptual vocal quality and fluency of these individuals. The post-treatment voice and disfluency measures were still higher than normal levels. This study did not distinguish between stuttering and other disfluencies.

3. Purpose

Therefore, the purpose of this study is to review the fluency characteristics of ADSD patients prior to Botox treatment, after Botox treatment, and with matched controls. The specific research questions include:

- Is there a statistically significant difference in the percentage of stuttering in individuals with ADSD pre-Botox, individuals with ADSD post Botox, and healthy age and sex matched controls while reading the first paragraph (the first 98 words) of "The Rainbow Passage?"
- Is there a statistically significant difference in the percentage of other disfluencies in individuals with ADSD pre-Botox, Individuals with ADSD post Botox, and healthy age and sex matched controls while reading the first paragraph of "The Rainbow Passage?"
- Is there a statistically significant difference in the percentage of total disfluencies in individuals with ADSD pre-Botox, individuals with ADSD post Botox, and healthy age and sex matched controls while reading the first paragraph of "The Rainbow Passage?"

4. Participants

Participant samples were taken from a larger study completed by Cannito et al. (2004), containing 42 participants with ADSD who underwent examination, with a three- to six-week follow up, after initial botulinum toxin type A injection. The participants were 42 English-speaking adults with ADSD, ranging in age from 22 to 79 years, and 42 healthy English speakers, matched to the ADSD patients by age and sex who served as controls (+/- 1 year). An otolaryngologist, and a speech pathologist, following flexible endoscopy and voice examination, diagnosed all participants as having ADSD. Clinical severity before botulinum toxin type A injection was determined by consensus of 2 speech pathologists who listened to recorded speech samples. A 5-point ordinal scale was used (0 indicated absence of dysphonia; 1, mild dysphonia; 2, moderate dysphonia; 3, severe dysphonia; and 4, profound dysphonia) to establish severity. Control speakers achieved a score of 0 on the severity scale. From the initial participant pool the current study inclusion criteria included only those participants diagnosed with a severity rating of moderate severity or greater and their matched controls. This was done in order to gather a sample with clearly identifiable characteristics of ADSD and resulted in a participant pool for the current study of 28 English-speaking adults with ADSD (5 male and 23 female), ranging from 22 to 77 years old, years post onset of ADSD ranging from 1 to 24 years post diagnosis, and time post injection from ranging from 2 to 7 weeks.

- **Methods and Instrumentation**

As outlined in the Cannito et al. (1997) study, speech samples were comprised of an oral reading of the first paragraph of the "The Rainbow Passage" (Fairbanks, 1960). The participants were provided a printed version of the paragraph (98 words total) to read from and prior to collecting the sample, were encouraged to silently read the passage and subsequently provided an opportunity to ask questions about unfamiliar words. The participants were then instructed to read the passage aloud using a rate and style typical of their usual speaking pattern. Reading ability posed no significant difficulty to any of the participants, although occasional reading errors were exhibited by members of both groups. ADSD participant's speech samples were obtained two times throughout the study. The first reading was within two weeks prior to their first botulinum toxin type A injection and the second approximately between 2 to 7 weeks following the injection. All healthy sex and age matched controls read the passage only once. All samples were recorded in a sound proof room (for full technical specifications of original instrumentation used see Cannito et al., 1997).

- **Analysis Procedures**

In the current study, the KayPentax Computerized Speech Lab (CSL) Model 4500 (KayPentax Corp., Lincoln Park, NJ) and Praat (Boersma & Weenink, 2018) were used to review and play the speech samples for analysis. Two certified speech-language pathologists each with six plus years of experience independently analyzed 84 speech samples (28 pre Botox samples, 28 post-Botox samples and their age and sex matched controls) to identify stuttering, other disfluencies, and total disfluencies (stuttering plus other disfluencies). Following individual analyses, the two speech-language pathologists established reliability with an inter-rater reliability of 80.8%. When agreement between judges was not obtained, joint reanalysis of the reading sample was completed until consensus was established. This provided a sample with 100% consensus agreement between the two speech-language pathologists. After consensus was achieved, the percentage of stuttered words (%SW), percentage of other disfluent words (%ODW), and percentage of total disfluent words (%TDW) was then calculated for each of the 84 speech samples.

- **Statistical Analysis and Results**

All data was entered into a spreadsheet and analyzed using SPSS (IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0). The descriptive statistics are summarized in Table 1 below:

Table 1

Percentage of stuttered words (%SW), percentage of other disfluent words (%ODW), and percentage of total disfluencies (%TDW) during the different conditions (pre-botox, post-botox, control).

Condition/Calculation	N	Mean	Standard Deviation
Pre-botox %SW	28	0.66	0.79
Post-botox %SW	28	0.33	0.69
Control %SW	28	0.40	0.70
Pre-botox %ODW	28	0.55	1.23
Post-botox %ODW	28	0.36	0.63
Control %ODW	28	0.25	0.45
Pre-botox %TDW	28	1.20	1.82
Post-botox %TDW	28	0.69	0.93
Control %TDW	28	0.66	0.97

For the comparison between groups to compare percentage of stuttering (%SW), three separate paired t-tests were used (pre-post Botox; pre-Botox to control; post-Botox to control). The assumptions of the paired t-test include normality of distribution of the difference score between groups and no significant outliers. For the pre-post Botox %SW, normality of distribution of the difference score was violated (Shapiro-Wilk < .05) and inspection of the data indicated one outlier. Therefore, the nonparametric equivalent Wilcoxon paired samples test was used for the analysis. The results indicate no significant difference between the pre- and post-Botox groups for %SW (z = -1.60, p = .110). For the pre-Botox/control %SW comparison, normality of distribution of the difference score was violated (Shapiro-Wilk < .05) and inspection of the data also indicated two outliers. Once again, the nonparametric equivalent Wilcoxon paired samples test was used for the analysis. The results indicate no significant difference between the pre-Botox and control groups for %SW (z = -1.07, p = .286). For the post-Botox/control %SW comparison, normality of distribution of the difference score was violated (Shapiro-Wilk < .05) and inspection of the data also indicated nine outliers. Therefore, the Wilcoxon paired samples test was used for the analysis. The results indicate no significant difference between the post-Botox and control groups for %SW (z = -0.36, p = .720).

For the comparison between groups to compare percentage of other disfluencies (%ODW), three separate paired t-test were used (pre-post Botox; pre-Botox to control; post-Botox to control). For the pre-post Botox %ODW, normality of distribution of the difference score was violated (Shapiro-Wilk < .05) and inspection of the data indicated three outliers. Thus, the nonparametric equivalent Wilcoxon paired samples test was used for the analysis. The results indicate no significant difference between the pre- and post-Botox groups for %ODW (z = -0.52, p = .604). For the pre-Botox/control %ODW, normality of distribution of the difference score was violated (Shapiro-Wilk < .05) and inspection of the data indicated one outlier. Therefore, the nonparametric equivalent Wilcoxon paired samples test was used for the analysis. The results indicate no significant difference between the pre-Botox and control groups for %ODW (z = -0.68, p = .496). For the post-Botox/control %ODW, normality of distribution of the difference score was violated (Shapiro-Wilk < .05) and inspection of the data also indicated five outliers. The nonparametric equivalent Wilcoxon paired samples test was used for this analysis. The results indicate no significant difference between the post-Botox and control groups for %ODW (z = -0.21, p = .831).

For the comparison between groups to compare percentage of total disfluent words (%TDW), three separate paired t-test were used (pre-post Botox; pre-Botox to control; post-Botox to control). For the pre-post Botox %TDW, normality of distribution of the difference score was violated (Shapiro-Wilk < .05) and inspection of the data indicated five outliers. Again, the nonparametric equivalent Wilcoxon paired samples test was used for the analysis. The results indicate no significant difference between the pre- and post-Botox groups for %TDW (z = -1.09, p = .274). For the pre-Botox/control %TDW, normality of distribution of the difference score was violated (Shapiro-Wilk < .05) and inspection of the data also indicated one outlier. Therefore, the nonparametric equivalent Wilcoxon paired samples test was used for the analysis. The results indicate no significant difference between the pre-Botox and control groups for %TDW (z = -1.10, p = .268). For the post-Botox/control %TDW, normality of distribution of the difference score was violated (Shapiro-Wilk < .05) and inspection of the data also indicated five outliers. Once again, the nonparametric equivalent Wilcoxon paired samples test was used for the analysis. The results indicate no significant difference between the post-Botox and control groups for %TDW (z = -0.29, p = .977).

- **Discussion**

Based on the current findings, there were no significant differences among groups (pre-botox ADSD, post-botox ADSD, and matched controls) for %SW, %ODW nor %TDW. This is somewhat different from previous findings (Cannito et al., 1997; Cannito et al., 2004). There are two likely reasons for these differences. One being the method of analysis used here. The distinction between stuttering and other disfluencies is an important distinction when evaluating clients labeled as exhibiting "stuttering." The types of fluency breakdowns can be different in clients that do not have childhood onset stuttering (e.g. Van Borsel & Tetnowski, 2007). Clearly, there are fluency breakdowns in ADSD patients, however, they may be different than more typical childhood onset stuttering. This is worthy of further study.

Secondly, the differences from the earlier Cannito studies may be due to the participant selection method used in this study. The use of only moderate and severe ADSD participants likely had an influence and could explain why the %TDW score were not consistent with the Cannito et al. (2004) results.

In summary, the results of this study revealed no significant differences between groups when considering a narrow, but widely-used taxonomy of stuttering. Neither did this study show differences between groups for other disfluences or total disfluencies. Since the perceptual definition of ADSD contains voice stoppages and other breakdowns of fluency, clinicians are likely to count or classify in this way. The present findings suggest that the fluency breakdowns in ADSD do not meet with our current descriptions of stuttering, other disfluencies, or total disfluencies.

References

Aronson, A. E., Brown, J. R., Litin, E. M., & Pearson, J. S. (1968). Spastic dysphonia. I. Voice, neurologic, and psychiatric aspects. *Journal of Speech and Hearing Disorders, 33,* 203-218.

Boersma, P., & Weenink, D. (2018). Praat: doing phonetics by computer [Computer program]. Version 6.0.40, retrieved 11 May 2018 fromhttp://www.praat.org.

Cannito, M. P., Burch, A. R., Watts, C., Rappold, P. W., Hood, S. B., & Sherrard, K. (1997). Disfluency in spasmodic dysphonia, *Journal of Speech, Language, and Hearing Research, 40*, 627-641.

Cannito, M. P., Woodson, G. E., Murry, T., & Bender, B. (2004). Perceptual analysis of spasmodic dysphonia before and after treatment. *Archives of Otolaryngology Head and Neck Surgery, 130*, 1393-1399.

Darley, F. L., & Spriestersbach, D. C. (1978). *Diagnostic Methods in Speech Pathology*. New York: Harper & Row.

DeNil, L. F., Jokel, R., & Rochon, E. (2007). Etiology, symptomatology, and treatment of neurogenic stuttering. In E. G. Conture and R. F. Curlee (Eds.), *Stuttering and related disorders of fluency* (pp. 326-343). New York: Thieme Medical Publishers, Inc.

Fairbanks, G. (1960). *Voice and articulation drillbook* (2nd ed.). New York, NY: Harper & Row.

Ham, R. E. (1989). What are we measuring? *Journal of Fluency Disorders*, 14, 231-243.

IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.

Ingham, R. J., Cordes, A. K., & Finn, P. (1993). Time-interval measurement of stuttering: Systematic replication of Ingham, Cordes, & Gow. *Journal of Speech and Hearing Research, 36*, 1168-1176.

Ingham, R. J., Cordes, A. K., & Gow, M. L. (1993). Time-interval measurement of stuttering: Modifying interjudge agreement. *Journal of Speech and Hearing Research, 36*, 503-515.

Moore, S. E., & Perkins, W. H. (1990). Validity and reliability judgements of authentic and simulated stuttering. *Journal of Speech and Hearing Disorders, 55*, 383-391.

Tetnowski, J. A., & Schagen, A. M. (2001). A comparison of listener and speaker perceptions of stuttering events. *Journal of Speech-Language Pathology and Audiology, 25*, 8-18.

Van Borsel, J. & Tetnowski, J. A. (2007). Stuttering in genetic syndromes. *Journal of Fluency Disorders, 32*, 279-296.

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