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A Study of Disfluency Characteristics According to Auditory Feedback Condition

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Purpose : While people have the ability to detect their errors and correct them naturally and appropriately during the process of speaking, stutterers are affected by the auditory feedback conditions of the kind of feedback used to speak. It has been suggested that auditory feedback conditions can also be used in treatment. However, when presenting a variety of auditory feedback conditions, stutterer characteristics are not revealed; whether this has any difference with the normal group has not yet been reported. This study aims to clarify disfluency characteristics in a stuttering group and to examine how the characteristics differ from a normal group.

Methods : Ten stuttering adults and 10 normal adults participated in the study. The samples were collected from course of speaking tasks including reading and monologue. Auditory feedback conditions were collected through collated samples using MAF, choral speech, DAF, and FAF conditions. Using the collected samples, disfluency characteristics were investigated by analyzing frequency and speech rate.

Results : The results of this study were as follows. First, there was a significant difference of disfluency frequency between the two groups in reading and monologue according to the auditory feedback condition. Second, there was a significant difference in the speech rate between the two groups in reading and monologue according to auditory feedback condition, but there was no significant difference of speech rate.

Conclusions : Based on the results of this study, it is hoped that auditory feedback conditions can be applied effectively to the treatment of adult stuttering.

Keywords : Stuttering, auditory feedback condition, frequency of stuttering, speech rate

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Ⅰ. Introduction

While research on the causes of stuttering has been conducted with a considerable number of themes, the causes are still unclear and plural (Guitar, 1998). One of many causes of stuttering that are directly associated with intervention is the auditory feedback mechanism. Feedback actions vary in the process of calculating words. Bloodstein (1995) that the normal speech production process is an automatic process that depends on feedback. Feedback in the process of speech is the of interaction between auditory and orosensory clues. Normal speakers create feedback adjusting auditory and orosensory clues properly, whereas stutterers pay a great deal of attention to auditory clues (Barber, 1940).

Thus, choral speech and masking auditory feedback (MAF) have been harnessed as clues to change the auditory feedback conditions for stutterers since the 1930s. Andrews et al. (1982) on a study on three stutterers that presenting a variety of auditory feedback conditions, speech pattern changed stuttering could be reduced. Kiefte & Armson (2008) reported to have reduced the frequency of stuttering when applying and altered auditory feedback (AAF) for 17 adults. Eliminating or changing auditory clues for stutterers and having them rely on oral clues resulted in the removal of stuttering (Ryan, 2001). Afterward, constant research has been conducted on whether stuttering contributes to any damage to the auditory feedback mechanism that supplements speech production among stutterers (Fairbank, 1955; Mysak, 1960; Stromsta, 1972).

In the 1950s, research focused on the contributions of delayed auditory feedback (DAF) to the reduction in stuttering and it was suggested that DAF played a critical role in reducing stuttering among people who stutter (PWS). Howell et al. (1987) used frequency altered feedback (FAF) to reduce stuttering among PWS and suggested a new aspect of auditory feedback conditions.

DAF has long been studied on the part associated with decreased non-fluency behavior. Kalinowski et al. (1999) compared the stuttering frequency in the DAF and natural auditory feedback (NAF) by delaying to 25, 50, and 75ms in a reading monologue conversation task. He subsequently claimed that stuttering behavior is reduced in the DAF rather than the NAF. In addition, leading researchers compared the speech characteristics of the normal group and the PWS group when presenting the DAF (Bloodstein, 1995). Non-fluent behaviors that appear in normal adults include five tones, speech strength increase, and clarity decline (Fukawa & Yoshida, 1985; Howell et al., 1999; Stager & Ludiow, 1993). Researchers have argued that under DAF, the brokenness of the collotry calculate normal adults appears similar to stuttering (Fuwaka, 1985; Kim & Shin, 2019; Kim et al., 2019).

The research on auditory feedback through FAF was again noted by researchers on stuttering in relation to the auditory feedback conditions and then conducted in many areas. In this context, a number of studies, including those using choral speech (Armonson et al., 1998; Freeman & Armson, 1998) and those on masking speech and the characteristics of PWS (Howell et al., 1987; Kalinoski et al., 1993), were conducted. Many different methods have been used by applying DAF (Sparks et al., 2002; Van Borsel et al., 2003) or FAF to characterize PWS (Howell et al., 1999; Kalinowski, 1999; Natke et al., 2001).

Previous studies related to the auditory feedback conditions were accomplished in terms of whether each auditory condition reduced the frequency of stuttering in the stuttering group and, if so, how much it was affected. It was also reported that most of the auditory feedback conditions were effective in reducing the frequency of stuttering. The research described the auditory characteristics of PWS that reduced the frequency of stuttering through distraction (Barber, 1940), injured auditory functions (Stromsta, 1972), and modified voices (Perkins, 1979) but has not presented a definite ground yet.

To clarify the ground, many studies have been to present PWS with auditory feedback mechanism conditions in diverse ways and to use each auditory feedback mechanism condition to reduce stuttering. However, few studies have been performed to indicate the differences among the conditions. In a limited way, recent research made a comparison between DAF and FAF (Kalinowski et al., 2004; Stuart et al., 2004; Zimmerman et al., 1997) and between choral speech and FAF (Freeman & Armson, 1998; Kiefte & Armson, 2007). However, no comprehensive research has been conducted on the contributions of the auditory feedback mechanism conditions to the reduction in stuttering among PWS.

To characterize PWS given auditory feedback conditions, it is possible to specify the characteristic so PWS only by knowing how normal adults react to the auditory feedback conditions. However, research the auditory feedback conditions in the PWNS group is limited to DAF conditions (Fukawa & Yoshida, 1985; Stuart et al., 2004). It is therefore necessary to determine how speech differs by various types of auditory feedback conditions in the PWNS group.

The ultimate goal of treating PWS is to develop fluency in every situation (Ryan, 2001). If auditory feedback conditions contribute to the reduction in stuttering among PWS, it is necessary to determine what utterance task has the greatest impact. However, Zimmerman et al. (1997) me rely investigated the effects for PWS in the situation of telephone and most related researches were limited to utility in reading situations (Howell et al., 1999; Kalinowski et al., 2004). It is therefore necessary to determine by utterance tasks with the objective of clarifying the differences in the auditory feedback conditions for PWS and applying them to treatment more usefully. Based on the significances of the research, the purpose was to characterize disfluency speech under diverse types of auditory feedback conditions in stuttering adults according to auditory feedback conditions.

II. Methods

1. Subject

This study was conducted among 10 PWS and PWNS. PWS had stuttered without cerebral injury since their childhood and were diagnosed with severe stuttering by a speech therapist by means of a stuttering severity instrument (SSI). The mean age was 29.6 years (range=19~42; *SD*=7.22). Each of them possessed normal hearing and carried no problem with speech or language but with fluency. PWNS were selected as subjects who had never been diagnosed with stuttering. PWNS exhibited normal hearing no problems with spoken language besides fluency.

Table 1. Information of participants

	PWNS	PWS
n	10	10
M (*SD*)	25.30 (1.41)	29.60 (7.22)

Note. PWNS=people who not stutter; PWS=people who stutter.

2. Experimental Instrument

1) Feedback Conditions

This study presented four feedback conditions. The experiment applied the following instruments: (1) MAF: To present white noises as masking noises, (2) Choral speech: A normal male recorded a reading material. Feedback was provided on recordings in a noiseless place. The researchers raised their hands to the PWS at the beginning of the recording to provide clues, (3) DAF: DAF delay level was presented by setting the Speecheasy speed regulator to 200ms. The delay rate standard was based on the DAF treatment program of Ryan (2001), (4) FAF: The FAF only changed the pitch without modulating the speed. Regardless of the msec, the intensity of the frequency-to-mapping factor of the 16 bands was 4dB at 1k, 12dB at 1k8, 16dB at 2k2, 16dB at 2k8, 12dB at 3k2, and 4dB at 3k8, the strength of the remaining frequency map was 'O'dB. FAF was presented with a -1000Hz.

In order to prevent the learning effect the feedback conditions were leveled (counter balance) during the laboratory sequence by subject. After each feedback condition was performed and the SpeechEasy was subtracted from the ear after a free conversation with the tester for 3 minutes, the next delay level was carried out.

2) Utterance Task

The reading tasks used in this study were devised in sentences consisting of 400 syllables, taking into account the speech rate of normal adults using sentences presented in high school textbooks (Ministry of Education and Science Technology, 2010). The reading data was designed in five ways with an equivalent reading level to prevent adaptive effects. The reading materials were all presented in A4 paper, and the size of the letters, the spacing of the lines, the spacing and margins of the letters were all the same.

The topics used in the monologue task were taken into account the topics used in Ryan (2001) fluency interview forms, speaking alone and in monologues. In addition, 25 topics that can be familiar to the subjects in their daily lives were selected. This topic was selected as a familiar topic after a five-point scale for 20 adults. Topics were family, work, hobbies, travel, movies, military, friends, favorite sports in school et al.

3) Feedback Tool

The following tool was used to present auditory feedback conditions: The auditory feedback conditions in Experiments 2 and 3 are presented through a headset according to the feedback level on a laptop (XNOTE E200). The auditory feedback conditions in Experiments 4 and 5 are presented by using tympanic CIC through the external volume regulator of SpeechEasy.

3. Sample Analysis

Stuttering frequency was counted for nonfluency behaviors such as repetition, prolongation, and closure. The discrimination was determined by judgment as to whether repetition, extension, or obstruction occurred. When several non-fluency behaviors within one word, they were classified as the most severe. The stuttering frequency was calculated as the stuttering frequency per minute.

Speech rate was measured for reading monologue tasks in terms of the number of syllables spoken per minute (SS/M) or the number of syllables per minute (SR/M). The spoken syllable or read syllable coefficients were calculated on the disfluent speaker. However, interpolated words such as and “eum” were not counted as spoken and read syllables. Speech rate was measured with a stopwatch and was based on the total spoken time and reading time, no pauses of 1 second or more included.

4. Inter-rater Reliability

In this study, Inter-rater reliability of the analysis of In this study, inter-rater reliability of the analysis of stuttering behavior and speech rate was obtained by one patient with more than 5 years of experience in speech therapy and with a first-class speech therapist certificate and the same sample. The data used for the reliability calculation were analyzed with three spoken samples randomly selected from the data collected from the subjects. Reliability between raters was 96% for stuttering behavior and 95% for speech rate.

5. Data Analysis

Two-way ANOVA was performed to characterize speech

in the PWS and PWNS groups according to the auditory feedback conditions Scheffe test was carried out to determine the significant differences among the feedback conditions.

Ⅲ. Results

1. Frequency of Stuttering

1) Reading Task

Reading tasks were implemented to determine the differences in the frequency of stuttering by the feedback conditions between the PWS and PWNS groups. The mean and standard deviation of the frequency of stuttering under each auditory feedback condition is as presented in Table 2.

Table 2. Average and standard deviation stuttering frequency in reading

	PWNS		PWS	
	M	*SD*	*M*	*SD*
NAF	.24	.78	2.70	1.88
MAF	.00	.00	1.06	1.15
CS	.00	.00	.39	.47
DAF	.00	.00	.42	.43
FAF	.55	1.17	.25	.46

Note. NAF=natural auditory feedback; MAF=masking auditory feedback; CS=choral speech; DAF=delayed auditory feedback; FAF=frequency altered feedback.

Two-way ANOVA was performed to determine the differences in the frequency of stuttering between the two groups by the feedback conditions and the results are as presented in Table 3. Significant differences were found in the interaction effects between the auditory feedback conditions and grouping, as presented in Table 3 ($F_{(4, 90)}$=4.247, p<.01). There were significant inter-group differences ($F_{(1, 90)}$=16.481, p<.01). Significant differences were found among the feedback conditions ($F_{(4, 90)}$=5.570, p<.01).

Scheffe test was carried out to determine the significant differences among the feedback conditions and the results are as presented in Table 4. As presented in Table 4, NAF differed significantly from masking and choral speech, DAF, and FAF (p<.05), whereas no significant difference was found among the other conditions.

Table 3. Two-way ANOVA analysis results in reading

	SS	*df*	*MS*	*F*
Group	16.481	1	16.481	22.018**
Feedback	22.279	4	5.570	7.441**
Group × Feedback	21.697	4	5.424	4.247**
Error	67.368	90	.749	
Total	159.745	100		

** p<.01

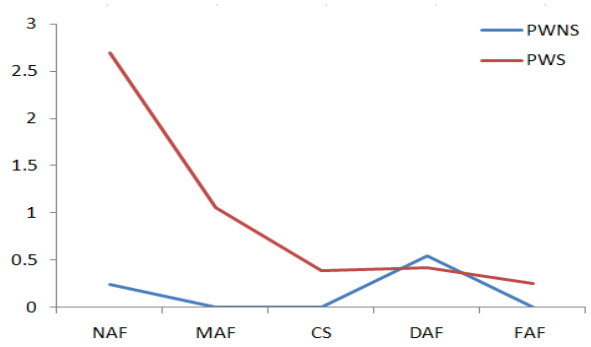
Table 4. Post hoc analysis in reading task

	NAF	MAF	CS	DAF	FAF
NAF					
MAF	.94*				
CS	1.27*	.33			
DAF	1.06*	.12	.20		
FAF	1.26*	.31	.19	29.90	

Note. NAF=natural auditory feedback; MAF=masking auditory feedback; CS=choral speech; DAF=delayed auditory feedback; FAF=frequency altered feedback.

* p<.05

Figure 1 was presented to determine the differences in the frequency of stuttering between PWS and PWNS groups among the auditory feedback conditions for the reading tasks. As shown in Figure 1, the PWS group more frequently stuttered than PWNS group under all the conditions but DAF. The PWS group had stuttering decreased under the other auditory feedback conditions than NAF. In contrast, the PWNS group rather had stuttering increased under DAF, as compared with NAF. As for the comparison between PWS and PWNS groups by the auditory feedback conditions for the reading tasks, the PWNS group showed no stuttering under masking and choral speech and FAF. It more frequently showed stuttering under DAF than the PWS group.



Note. PWNS=people who not stutter; PWS=people who stutter; NAF=natural auditory feedback; MAF=masking auditory feedback; CS=choral speech; DAF=delayed auditory feedback; FAF=frequency altered feedback.

Figure 1. Differences in the frequency of stuttering between groups in reading task

2) Monologue Task

Monologue tasks were implemented to determine the differences in the frequency of stuttering by the feedback conditions between the PWS and PWNS groups. The mean and standard deviation of the frequency of stuttering under each auditory feedback condition is as presented in Table 5.

Table 5. Average and standard deviation stuttering frequency in monologue

	PWNS		PWS	
	M	*SD*	*M*	*SD*
NAF	.06	.20	6.07	2.62
MAF	.00	.00	4.15	3.25
DAF	.20	.46	1.93	1.87
FAF	.13	.41	2.19	1.49

Note. PWNS=people who not stutter; PWS=people who stutter; NAF=natural auditory feedback; MAF=masking auditory feedback; DAF=delayed auditory feedback; FAF=frequency altered feedback.

Two-way ANOVA was performed to determine the differences in the frequency of stuttering between the two groups by the feedback conditions and the results are as presented in Table6. Significant differences were found in the interaction effects between the auditory feedback conditions and grouping, as presented in Table 6 ($F_{(3, 72)}$=6.714, p<.01). There were significant inter-group differences ($F_{(2, 72)}$=82.370, p<.01). Significant differences were found among the feedback conditions ($F_{(3, 72)}$=5.894, p<.01).

Table 6. Two-way ANOVA analysis results in monologue

	SS	*df*	*MS*	*F*
Group	243.599	1	243.599	82.370**
Feedback	52.295	3	17.432	5.894**
Group × Feedback	59.570	3	19.857	6.714**
Error	212.930	72	2.957	
Total	840.933	80		

**p<.01

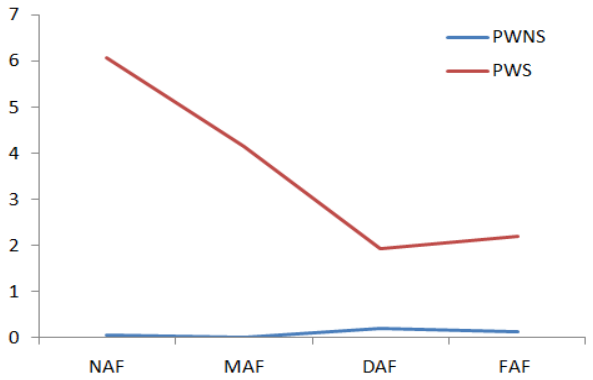
Scheffe test was carried out to determine the significant differences among the feedback conditions and the results are as presented in Table 7. As presented in Table 7, NAF differed significantly from DAF and FAF (p<.01) but didn't differ significantly from masking. No significant difference was found among the remaining conditions.

Figure 2 was presented to determine the differences in the frequency of stuttering between the PWS and PWNS groups among the auditory feedback conditions for the monologue tasks. As shown in the Figure 2, the PWS group more frequently stuttered than the PWNS group under every condition. The PWS group had stuttering decreased under the other auditory feedback conditions than NAF. The PWNS group rather had stuttering increased in DAF and FAF than NAF. As for the comparison between the PWS and PWNS groups by the auditory feedback conditions for the monologue tasks, the PWNS group showed no stuttering under masking.

Table 7. Post hoc analysis in monologue

	NAF	MAF	DAF	FAF
NAF				
MAF	.99			
DAF	1.99*	1.00		
FAF	1.90*	.91	.09	

Note. NAF=natural auditory feedback; MAF=masking auditory feedback; DAF=delayed auditory feedback; FAF=frequency altered feedback.
*p<.05



Note. PWNS=people who not stutter; PWS=people who stutter; NAF=natural auditory feedback; MAF=masking auditory feedback; DAF=delayed auditory feedback; FAF=frequency altered feedback.

Figure 2. Differences in the frequency of stuttering between groups in monologue task

2. Speech Rate

1) Reading Task

Reading tasks were implemented to determine the differences in the frequency of stuttering by the feedback conditions between the PWS and PWNS groups. The mean and standard deviation of the speech rate under each auditory feedback condition is as presented in Table 8.

Table 8. Average and standard deviation speech rate in reading task

	PWNS		PWS	
	M	*SD*	*M*	*SD*
NAF	319.41	36.99	211.06	64.54
MAF	295.14	29.26	213.42	53.24
CS	270.57	31.18	258.38	15.44
DAF	313.36	30.09	245.66	55.47
FAF	270.82	59.79	197.50	70.01

Note. PWNS=people who not stutter; PWS=people who stutter; NAF=natural auditory feedback; MAF=masking auditory feedback; CS=choral speech; DAF=delayed auditory feedback; FAF=frequency altered feedback.

Two-way ANOVA was performed to determine the differences in the speech rate between the two groups by the feedback conditions and the results are as presented in Table 9. Significant differences were found in the interaction effects between the auditory feedback conditions and grouping, as presented in Table 9 ($F_{(4, 90)}$=2.706, p<.05). There were significant inter-group differences ($F_{(1, 90)}$=51.465, p<.01). Significant differences were found among the feedback conditions ($F_{(4, 90)}$=2.462, p<.05).

Table 9. Two-way ANOVA analysis results in reading

	SS	*df*	*MS*	*F*
Group	117847.3	1	117847.3	51.465*
Feedback	22546.104	4	5636.526	2.462**
Group × Feedback	24785.916	4	6196.479	2.706*
Error	206086.1	90	2289.846	
Total	710754	100		

*p<.05, **p<.01

Scheffé test was carried out to determine the significant differences among the feedback conditions and the results are as presented in Table 10. As presented in Table 10 NAF, masking and choral speech, DAF, and FAF all made no significant difference.

Table 10. Post hoc analysis in reading task

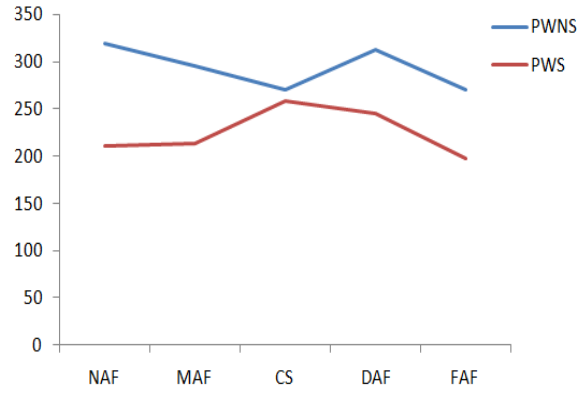
	NAF	MAF	CS	DAF	FAF
NAF					
MAF	10.94				
CS	.75	10.19			
DAF	14.27	25.22	15.03		
FAF	31.07	20.12	30.31	45.34	

Note. NAF=natural auditory feedback; MAF=masking auditory feedback; CS=choral speech; DAF=delayed auditory feedback; FAF=frequency altered feedback.

Figure 3 was presented to determine the differences in the speech rate between the PWS and PWNS groups among the auditory feedback conditions for the reading tasks. As shown in the Figure 3, the PWS group was slower in speech than the PWNS group under every condition. The PWS group had the speech rate raised under the other auditory feedback conditions than FAF, as compared with NAF, in terms of stuttering. The PWS group rather had the speech rate lowered under all the conditions, as compared with NAF.

2) Monologue Task

Reading tasks were implemented to determine the differences in the frequency of stuttering by the feedback conditions between the PWS and PWNS groups. The mean and standard deviation of the speech rate under each auditory feedback condition is as presented in Table 11.



Note. PWNS=people who not stutter; PWS=people who stutter; NAF=natural auditory feedback; MAF=masking auditory feedback; CS=choral speech; DAF=delayed auditory feedback; FAF=frequency altered feedback.

Figure 3. Differences in the speech rate between groups in reading task

Table 11. Average and standard deviation speech rate in monologue task

	PWNS		PWS	
	M	*SD*	*M*	*SD*
NAF	237.61	35.90	165.23	39.77
MAF	259.54	38.22	182.14	72.14
DAF	269.59	42.59	197.85	58.72
FAF	217.59	35.29	177.10	76.93

Note. PWNS=people who not stutter; PWS=people who stutter; NAF=natural auditory feedback; MAF=masking auditory feedback; DAF=delayed auditory feedback; FAF=frequency altered feedback.

Two-way ANOVA was performed to determine the differences in the speech rate between the two groups by the feedback conditions and the results are as presented in Table 12. No interaction effect was found between the auditory feedback conditions and grouping, as presented in Table 12. There were significant inter-group differences ($F_{(1,\ 72)}$=31.251, p<.01). No significant difference was found among the feedback conditions.

Table 12. Two-way ANOVA analysis results in monologue task

	SS	*df*	*MS*	*F*
Group	85806.834	1	85806.834	31.251**
Feedback	17390.273	3	5796.758	2.111*
Group × Feedback	4268.678	3	1422.893	.518
Error	197689.7	72	2745.690	
Total	305155.5	79		

*p<.05, **p<.01

Ⅳ. Discussion and Conclusion

This study aimed to determine the behavioral characteristics of stuttering according to the auditory feedback mechanism conditions. Significant differences were found between the stuttering and normal adult groups in the frequency of stuttering for the reading and monologue tasks. The results of this study were consistent with those of the previous research (Fukawa & Yoshida, 1985).

Attention is paid to the fact that the normal group stuttered under DAF and FAF for the reading and monologue tasks. For the reading task, the normal group made no stuttering under any other condition than NAF but committed more stuttering under DAF 200 than even the stuttering group.

This result is consistent with the finding that altered auditory feedback led to speech breakdown for normal speakers (Fukawa & Yoshida, 1985; Howell, 1990; Stager & Ludlow, 1993). In particular, it has been suggested that normal speakers show an increase in speech rate fluctuation, syllable repetition, omission, and misarticulation, generating artificial speech, like stuttering (Johne & Striemer, 2007). In addition, it has been indicated that in the normal group, children are more likely to show breakdown than adults and that the older , the less likely they are to be affected by auditory feedback conditions (Fabbro & Darro, 1995).

Fukawa & Yoshida (1985) investigated sensitivity during a reading task under DAF in 40 PWS and 40 PWNS. Under DAF, the stuttering group was significantly more sensitive while the normal adult group was responsive. This study also found that the stuttering group was less likely to stutter under DAF than under NAF. Therefore, the PWNS, as well as the PWS, may produce speech under the influence of the auditory feedback conditions. This result confirms that altered auditory feedback has an auditory impact in speakers while they speak (Bauer et al., 2006; Butnett et al., 1997; Jone & Munhall, 2000).

In addition, the frequency of stuttering was lower under other auditory feedback conditions than NAF. This result conforms to the suggestion that altered auditory feedback can reduce the frequency of stuttering for PWS (Howell et al., 1987; Kalinowski et al., 1993; Stuart et al., 2004). Researchers assumed that PWS would be affected by auditory feedback due to auditory and perceptive deficiency (Cherry & Sayers, 1956; Mysak, 1960). They also

assumed that altered auditory feedback mechanism could make PWS more fluent speakers (Wingate, 1970).

Research has been conducted continuously to test these hypotheses. Such auditory feedback conditions as choral speech (Bloodstein, 1950; Freeman & Armson, 1998), MAF (Conture & Brayton. 1975; Kalinowski et al., 1993), DAF (Kalinowski et al., 1993; Spark et al., 2002), and FAF (Armson, & Stuart, 1998; Hargrave et al., 1994; Stuart et al., 1993) were found to be effective in reducing stuttering. The auditory feedback conditions have been used to test PWS (Goldiamond, 1970; Ryan, 1964; Van Borsel, 2003). The auditory feedback conditions were also useful in treating stuttering.

The PWS group registered significantly lower in speech rate for both reading and monologue tasks than the normal group. With the exception of the DAF, which involves an artificial decrease in the rate, NAF produced the slowest speech in the stuttering group. Wingate (1970) is consistent with the view that the fluency enhancement effect of all DAF is slowing down speech rate. In addition, Kailnowski et al. (1999) suggested that it is not essential to improve stuttering by inducing fluency to vary the speed of speaking. Under NAF, they received feedback related to their speech production and naturally produced stuttering. This leads to the same prediction as previous research made that stutterers are slow in speech due to closed time during stuttering (Ryan, 2001). This study looked at the relevance of the FAF and the stutterer's speech rate change. Researchers do not notice a significant difference in the speech rate of stutterers depending on FAF pitch ingest edits (Hargrave et al., 1994; Kalinowski et al., 1993; Stuart et al., 2004). For these results, the researchers argue that the FAF does not affect speed because the sound is adjusted.

We looked for significant differences in stuttering frequency and speech rate between normal and stuttering groups by auditory feedback. First of all, there were differences in stuttering behavior in reading and monologue tasks under shielding conditions. When the normal person heard or did not hear his voice, he was able to reassert himself that everyone had the ability to adjust naturally. On the other hand, the level of anxiety that a PWS group creates when it hears itself stuttering when it is not able to hear it (Bloodstein, 1995). However, it can be seen that even in the PWS group, the PWS and PWNS groups show significant differences.

While the frequency of stuttering was different between groups under the conditions of the CS, there was no statistically significant difference between the stuttering and PWNS group under the conditions of the CS conducted in the reading task. The conditions of the CS were that the speech rate was calculated at the same speech rate as the PWS and PWNS groups because they presented pre-recorded materials. Therefore, it can be considered once again that auditory feedback conditions are factors that can affect the stutter. It is clear that a CS is an auditory feedback condition suitable for a stuttering person so that it does not differ from the normal group not only in terms of stuttering frequency but also in terms of speech rate. However, the CS is not being used to treat stuttering. This is because the ultimate goal of stuttering treatment is to produce autonomous spoken language, because talking together is limited to formalized spoken or read tasks. It is also limited to include a joint spoken word in treatment because it requires the participation of others.

The PWS may think that the use of the DAF condition will reduce the stutter behavior (Kalinowski, 1996; Spark et al, 2002) and the PWNS group will yield the stutter (Bauer et al., 2006; John, 2007), thereby eliminating the difference in stutter behavior. The PWNS group showed stuttering behavior in both reading and monologue tasks under the DAF conditions, the same result of studies by Zannini et al. (1999) that normal subjects had speech errors when they delayed the DAF by 200 ms rather than by using the DAF.

Under FAF conditions, speech rate differed in both reading and monologue tasks. It could be found that the PWS and PWNS groups had similar characteristics. This could confirm that auditory feedback conditions were affecting not only stuttering but also normal groups.

On the basis of these results, a few suggestions can be made for further research

First, this study was limited to the adult stuttering group. Further research needs to forma comparison between children and adults to determine how the auditory feedback conditions affect by age among PWS and if the characteristics vary.

Second, the auditory feedback conditions exerted an impact on the PWNS group, as well as on the PWS group, as shown in the results. However, the research was limited to the frequency of stuttering and the speech rate so as to make a comparison the stuttering groups but it failed to characterize them clearly. Further research needs to analyze frequency fluctuation, speech clarity, and mal articulation patterns and determine the effects of auditory feedback mechanism more specifically in the PWNS.

Reference

Andrews, G., Howie, P. M., Dozsa, M., & Guitar, B. E. (1982). Stuttering: Speech pattern characteristics underfluency-inducing condition. *Journal of Speech, Language and Hearing Research, 25,* 208-216.

Armson, J., & Stuart, A. (1998). Effect of extended exposure to feedback on stuttering during reading and monologue. *Journal of Speech, Language and Hearing Research, 41,* 479-490. doi:10.1044/jslhr.4103.479

Barber, V. (1940). Studies in the psychology of stuttering. Rhythm as distraction in stuttering. *Journal of Speech Disorders, 5*, 29-42. doi:10.1044/jshd.0501.29

Bauer, J. J., Mittal, J., Larson, C. R., & Hain, T. C. (2006). Vocal responses to unanticipated perturbations in voice loudness feedback: Anautometic mechanism for stabilizing voice amplitude. *Journal of Acoustic Society, 119*, 2363-2371. doi:10.1121/1.2173513

Bloodstein, O. (1950). A rating scale study of conditions under which stuttering is reduced or absent. *Journal of Speech and Hearing Disorders, 15*, 29-36. doi:10.1044/jshd.1501.29

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

Cherry, C., & Sayers, B. (1956). Experiments upon the total inhibition of stammering by external controls and some clinical results. *Journal of Psycho Research, 1*, 233-246.

Conture, E. G., & Brayton, E. R. (1975). The influence of noise on stutterers different disfluency types. *Journal of Speech Hearing Research, 18,* 381-384. doi:10.1016/0022-3999(56)90001-0.

Guitar, B. (1998). *Stuttering: An integrated approach to its nature and treatment.* Vermont: Williams and Wilkins.

Goldiamond, I. (1970). Blocked speech communication and delayed feedback: An experimental design. *Journal of Speech, Language and Hearing Disorder, 34*, 253-260. doi:10.21236/ad0154612

Fabbro, F., & Darro, V. (1995). Delayed auditory feedback in polyglot simultaneous interpreters. *Brain and Language, 48,* 309-319. doi:10.1006/brln.1995.1013

Freeman, K., & Armson, J. (1998). Extent and stability of stuttering reduction during choral reading. *Journal of Speech-Language Pathology and Audiology, 22*, 188-202. doi:10.13064/ksss.2012.4.4.109

Fukawa, T., & Yoshida, S. (1985). Identification thresholds of nonsense syllables by stutterers. *Perceptual and Motor Skills, 63*, 592-594. doi:10.2466/pms.1986.63.2.592

Howell, P. (1990). Changes in voice level caused by several forms of altered feedback in fluent speakers and stutterers. *Language and Speech, 33*, 325-338. doi:10.1177/002383099003300402

Howell, P., El-Yaniv, N., & Powell, D. J. (1987). *Factors affecting fluency in stutterers when speaking under altered auditory feedback*. New York: Springer.

Howell. P., Sackin, S., & Williams, R. (1999). Differential effects of frequency-shifted feedback between child and adult stutterers. *Journal of Fluency Disorders, 24*, 127-136. doi:10.1016/s0094-730x(98)00021-7

Kalinowski, J., Armson, J., Roland-Mieszkowski, M., Stuart, A., & Gracco, V. L. (1993). Effects of alterations in auditory feedback and speech rate on stuttering frequency. *Language and Speech, 36,* 1-16. doi:10.1177/002383099303600101

Kalinowski, J., Stuart, A., Wamsley, L., & Rastatter, M. P. (1999). Effects of monitoring condition and frequency-altered feedback on stuttering frequency. *Journal of Speech, Language and Hearing Research, 42*, 1347-1354. doi:10.1044/jslhr.4206.1347

Kailnowski, J., Guntupalli, V. K., Stuart, A., & Saltuklaroglu, T. (2004). Self-reported efficacy of an ear-level prosthetic device that delivers altered auditory feedback for the management of stuttering. *International Journal of Speech, Language and Hearing Research, 42*, 1347-1354. doi:10.1097/01.mrr.0000128063.76934.df

Kiefte, M., & Armson, J. (2008). Dissecting choral speech: Properties of the accompanist critical to stuttering reduction. *Journal of Communication Disorders, 41*(1), 33-48. doi:10.1016/j.jcomdis.2007.03.002

Kiefte, K., & Armson, J. (2007). Dissecting choral speech: Properties of the accompanist critical to stuttering reduction. *Journal of Communication Disorders, 40*, 1-15. doi:10.1016/j.jcomdis.2007.03.002

Kim, H. J., & Shin, M. S. (2019). A literature review on childhood stuttering intervention. *Journal of Speech-Language & Hearing Disorders, 28*(2), 129-144. doi:10.15724/jslhd.2018.28.2.129

Kim, H. J., Chang, H. J., & Shin, M. S. (2019). Trends in domestic and international treatment research in stuttering adolescents and adults. *Journal of Speech-Language & Hearing Disorders, 28*(4), 21-37. doi:10.15724/jslhd.2019.28.4.021

Ministry of Education and Science Technology. (2010). *High school Korean textbook*. Seoul: Doosan DongA.

Mysak, E. D. (1960). Servo theory and stuttering. *Journal of Speech, Language and Hearing Research, 25,* 188-195. doi:10.1044/jshd.2502.188

Perkins, W. H. (1979). *From psychoanalysis to discoordination.* Baltimore: University Park.

Ryan, B. (1964). The use of DAF in the establishment of fluent reading and speaking in six stutterers. *Journal of Speech, Language and Hearing Disorder, 36,* 264-290. doi:10.1007/978-1-4613-3114-8_22

Ryan, B. (2001). *Programed therapy for stuttering in children and adults.* Springfild: Charles C Toms.

Stager, S. V., & Ludiow, C. L. (1993). Speech production changes under fluency-evooking conditions in nonstuttering speakers. *Journal of speech and Hearing Disorders, 36,* 245-235. doi:10.1044/jshr.3602.245

Stuart, A., Kalinowski, J., Rastatter, M., Saltuklaroglu, T., & Dayalu, V. (2004). Investigations of the impact of altered auditory

feedback in-the-ear devices on the speech of people who stutter: Initial fitting and 4-month follow-up. *International Journal of Language and Communication Disorders, 38*, 119-129. doi:10.1080/13682820310001616976

Sparks, G., Grant, D. E., Millay, K., Walker-Batson, D., & Hynan, L. S. (2002). The effect of fast speech rate on stuttering frequency during delayed auditory feedback. *Journal of Fluency Disorders, 27*(3), 187-201. doi:10.1016/S0094-730X(02)00128-6

Van Bosel, J., Reune, G., & Van den Bergh, N. (2003). Delayed auditory feedback in the treatment of stuttering: Clients as consumers. *International Journal of Language and Communication Disorders, 38*, 119-129. doi:10.1080/1368282021000042902

Wingate, M. (1970). Effect on the stuttering of changes in audition. *Journal of Speech Hearing Research, 13*, 861-873. doi:10.1044/jshr.1604.753b

Zimmerman, S., Kalinowski, J., Stuart, A., & Rastatter, M. (1997). Effect of altered auditory feedback on people who stutter during scripted telephone conversations. *Journal of speech, Language and Hearing Research, 40*, 1130-1134. doi:10.1111/1460-6984.12053

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청각적 피드백에 따른 비유창성 특성 연구

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목적: 사람들은 말을 하는 과정 가운데 자신의 오류를 탐지하여 자연스럽게 적절하게 수정할 수 있는 피드백의 능력을 가지고 있다. 말을 하는데 사용하는 피드백의 종류 중에 말더듬인은 청각적 피드백 조건에 많은 영향을 받고, 청각적 피드백 조건을 치료에도 이용된다는 것이 제시되고 있다. 하지만, 말더듬인에게 있어서 다양한 청각적 피드백 조건을 제시했을 때 특성은 밝혀지고 있지 않고, 정상집단과는 어떠한 차이를 가지고 있는지는 아직 제시하지 않고 있다. 따라서 연구의 목적은 청각적 피드백 조건에 따라 말더듬인의 비유창성 특성을 밝히고, 이러한 특성이 정상집단과 차이가 있는지 알아보고자 하는데 있다.

방법: 말더듬 집단과 정상 집단 각각 10명을 대상으로 읽기 및 독백의 발화 과업을 청각적 피드백 조건인 차폐, 합독구어, DAF조건, FAF조건을 이용해서 구어 표본을 수집하였다. 수집한 구어 표본은 말더듬 빈도 및 구어 속도를 산출하여 비유창성 특성을 비교 분석하였다.

결과: 본 연구의 결과는 다음과 같다. 첫째, 청각적 피드백 조건에 따른 말더듬 집단과 정상 집단은 읽기과업 및 독백 과업에서 말더듬 빈도에 유의한 차이가 있었다. 둘째, 청각적 피드백 조건에 따른 말더듬 집단과 정상 집단은 읽기 과업에서 구어 속도는 유의한 차이가 있었다. 독백 과업에서 구어 속도는 유의한 차이가 없었다.

결론: 본 연구 결과를 바탕으로 청각적 피드백 조건이 성인 말더듬 치료에 효용성 있게 적용하도록 활용되기를 기대한다.

검색어: 말더듬, 청각적 피드백 조건, 말더듬 빈도, 구어속도

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교육과학기술부 (2010). **고등학교 국어(하).** 서울: 두산동아.

김효정, 신명선 (2019). 국내외 아동 말더듬 중재에 대한 문헌 고찰. **언어치료연구, 28**(2), 129-144.

김효정, 장현진, 신명선 (2019). 말더듬 청소년 및 성인의 국내외 치료 연구 동향. **언어치료연구, 28**(4), 21-37.