

The Effects of Korean Traditional Rhythm Therapy on Voice of Parkinson's Disease Patients: A Preliminary Study

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ABSTRACT

The purpose of this study was to investigate the effects of rhythm therapy program on MPT(Maximum Phonation Time) and acoustic parameters in patients with Parkinson's disease. The therapy program utilized 5 Korean traditional rhythms: jinngyang, jungmori, jungjungmori, jajinmori, and semachi. The therapy consisted of counseling regarding vocal hygiene and actual therapy procedures. Six subjects with Parkinson's disease participated in the study; 3 subjects in experimental group and the other 3 subjects in control group. The pre- and post- acoustic analyses were performed in both groups. The results of this study were as follows; 1) MPT was significantly increased in the experimental group, 2) mono-pitch was significantly improved in the experimental group, 3) mono-loudness was significantly improved in the experimental group, and finally, HNR was significantly increased in the experimental group compared to the control group.

Keyword: Parkinson's disease, Korean traditional rhythm

1. Introduction

Human beings are living in the community through communications using languages. However, the patients with Parkinson's disease experience voice and speech disorders such as stuttering, decreased intensity, inaccurate articulation and abnormal prosody, which affect adversely speech articulation and undermine social, economic, and psychological satisfactions (Oxtoby, 1982; Ramig, 1992). Accordingly, these patients with Parkinson's disease need to undergo operations or receive medical and linguistic therapies. However, it has been reported that surgical and medical therapies are effective in curing tremor but insufficient to resolve voice and speech disorders of such patients (Baker et al., 1997). Approximately 70% of the patients with Parkinson's disease saw their communication and conversation abilities impaired through operations and medical treatments. The other operational treatments reported worsened speech articulation (Marsden & Parkes, 1976; Anderson et al., 1999; Benke et al., 2000; Goberman et al., 2003), decreased air flow (Vercueil et al., 1999), worsened lip and tongue movement (Gentil et al., 1998; Gentil et al., 1999; De Letter et al., 2003). Therefore, proper

therapies must be devised for voice and speech improvements of the patients under the influence of Parkinson's disease causing disorders in respiration, phonation, and articulation.

As one of the holistic voice therapies used for voice disorder patients, the Accent Method had been developed by Danish speech and voice therapist, Svend Smith around 1936. Smith thought that communication was based on accent and stress of spoken language and phonation and speech proceeded smoothly only after good respiration.

The Accent Method is based on abdominal-diaphragm breathing, accented and rhythmical vowel-consonant phonation, and body movements. Through a series of studies, the effect of the Accent Method on voice disorder patients has already been proved.

Kotby et al., (1991) reported that as the result of applying the Accent Method to 6 patients with vocal nodules and the results showed the decreased size of nodules in all patients. Park et al., (2000) also reported that as the result of carrying out the Accent Method as supplementary treatment for the vocal nodules, vocal polyp whose voice and speech were not improved despite medical operations. The results showed that Fo, RAP, shimmer, MPT and S/Z ratio were significantly improved. Also Fex et al., (1994) reported that PPQ, APQ, NNE, Fo, jitter, and shimmer were significantly improved after applying the Accent Method for the patients with functional dysphonia. Kwon et al., (2001) reported that as the result of carrying out the Accent Method except for the third stage (rhythmical body movements) of this method to 17 patients with vocal nodules, and jitter and shimmer were significantly improved and in particular MPT was more significantly improved than any other vocal parameters. Khidr et al., (2003) reported that voice quality was improved as the result of applying the Accent Method to the patients with vocal cord paralysis.

However, the study by Kwon et al., (2001) excluded the third stage of moving the body rhythmically from the original Accent Method. It was also pointed out the difficulty in applying the Accent Method originated from Europe.

Therefore, this study transformed the 3 Western rhythms (largo, andante, and allegro) used in the Accent Method into Korean traditional rhythms (jinnyang, jungmori, jungjungmori, jajinmori, and semachi).

The present study investigated the effects of Korean traditional rhythm therapy on voice of Parkinson's disease patients.

The specific research questions to be answered were as follows:

First, does MPT increase when Korean traditional rhythm therapy program is applied to patients with Parkinson's disease?

Second, does mono-pitch improve when Korean traditional rhythm therapy program is applied to patients with Parkinson's disease?

Third, does mono-loudness improve when Korean traditional rhythm therapy program is

applied to patients with Parkinson's disease?

And finally, dose the voice quality (jitter, shimmer, and HNR) improve when Korean traditional rhythm therapy program is applied to patients with Parkinson's disease?

2. Methods

Subjects

Six subjects with Parkinson's disease participated in this study. All subjects have sustained an idiopathic Parkinson's disease. In addition, all of them exhibited II or III disease level according to Hoehn and Yahr (1967). They reported to have normal eyesight, hearing, and cognition. The individual characteristics of the subjects were presented in Table 1.

Table 1. Subjects' characteristics

group	subject	gender	age (yrs)	IPD* (yrs)	disease level**	voice characteristics
experimental group	1	M	79	4	2	breathiness
	2	F	74	5	3	pitch break, breathiness
	3	F	73	3	2	monoloudness, breathiness
control group	4	M	74	5	2	monoloudness, breathiness
	5	M	68	12	3	monoloudness, breathiness
	6	M	62	4	3	breathiness

* IPD : idiopathic Parkinson's disease

** Hoehn & Yahr (1967)

Instruments and Procedure

The Korean traditional rhythm therapy program was applied to the experimental group only. The pre- and post- acoustic analyses were performed in both groups using Praat (version 4.2.20). Voice recording used the headset mike linked to AION Stereo Head Phone (AION - 300) and connected to the notebook computer (Samsung SENS P25) with sampling rate being set at 22050Hz. According to the study of Winholtz and Titze (1997), the headset mike ensures more effective recording than general stand mike when the heads of the subjects move considerably in recording voices.

In order to improve MPT, the authors had subjects inhale as much as possible and produce the vowel /a/. The results were measured in second by stop watch.

In order to evaluate mono-pitch and mono-loudness, the subjects read the Sanchaek passage (Jeong, 1994) comfortably and the variability of frequency and intensity were measured. In addition, the voice quality was analyzed by having the subjects produce the vowel /a/. The extreme values (lowest and highest) were eliminated in averaging the values.

Structure of Therapeutic Program

The first 5 sessions were conducted including vocal hygiene and respiration exercise. The following 15 sessions were the rhythm therapy.

1. Vocal Hygiene

The vocal hygiene counseling was carried out with a focus on things that they had to do such as sufficient water intake and things that they had to refrain from such as smoking.

2. Respiration Exercise

The respiration exercises were presented in Table 2.

Table 2. Respiration Exercise

Activities in Detail	
1)	The experimenter and subject sit on chairs with a comfortable posture in a quiet place.
2)	The experimenter demonstrates the abdominal breathing.
3)	The experimenter proposes subject to have the abdominal breathing.
4)	The author teaches subject to swell the abdominal muscles during inhalation and release the abdominal muscles during exhalation.
5)	The experimenter slightly taps the table in order to help subject adjust himself/herself to the rhythm while respiration.
6)	The experimenter requests subject to inhale and exhale as long as he/she can.
7)	The experimenter counts numbers "one, two, three" or taps the table until subject exhales air following inhalation.

3. Rhythm Exercise

The rhythm exercise was performed after the respiration exercise. The rhythm exercise accompanied bodily activities such as tapping knees and a small drum.

This program also included sing and humming to the rhythm.

Table 3 shows the ways to tap the small drum and Table 4 the sequence of the rhythms.

One of the rhythms, jinnyang rhythm program was presented in detail in Appendix I to illustrate an example.

Table 3. Tapping Methods

Verbal Output and Tapping Methods		
⊙	Dung	Tap the drum with both hands.
	Duk	Tap the drum with the right hand.
○	Kung	Tap the drum with the left hand.

Table 4. Progression Sequence of Rhythms

Rhythm		
jinngyang	→	jungmori jungjungmori
		→
		jajinmori semachi

Statistical Analysis

The verification of the statistical confidence was made by SPSS (version 10.0) and a paired t-test was performed as well as the independent sample t-test to examine the differences between the 2 groups.

3. Results and Discussion

MPT

This study was to determine the effects of Korean traditional rhythm therapy program on Parkinson disease patients.

Table 5 and Figure 1 showed the improvement of MPT.

Table 5. MPT

group	time of assessment	mean (sec.)	SD (sec.)
experimental group	pre-	8.67	3.21
	post-	12.33	3.79
control group	pre-	7.67	2.08
	post-	6.33	1.53

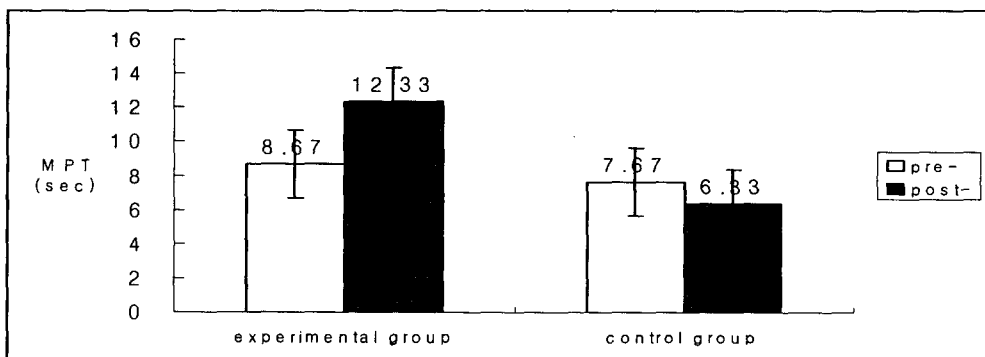


Figure 1. MPT Before and After the Therapy

The MPT average of the experimental group increased by 3.66. On the other hand, the average MPT for the control group decreased by 1.34 seconds.

Table 6 showed the results of the Paired t-test on MPT.

Table 6. Paired t-test on MPT

group	t	p
experimental group (n=3)	-5.500	0.032*
control group (n=3)	4.000	0.057

* $p < 0.05$

The MPT of the experimental group was significantly increased ($p < 0.05$). However, the MPT of the control group made no difference.

Mono-pitch

Table 7 and Figure 2 illustrated the improvement of frequency variability.

Table 7. Frequency Variability

group	time of assessment	mean (Hz)	SD (Hz)
experimental group	pre-	69.01	24.82
	post-	81.84	22.18
control group	pre-	81.45	14.59
	post-	67.13	7.08

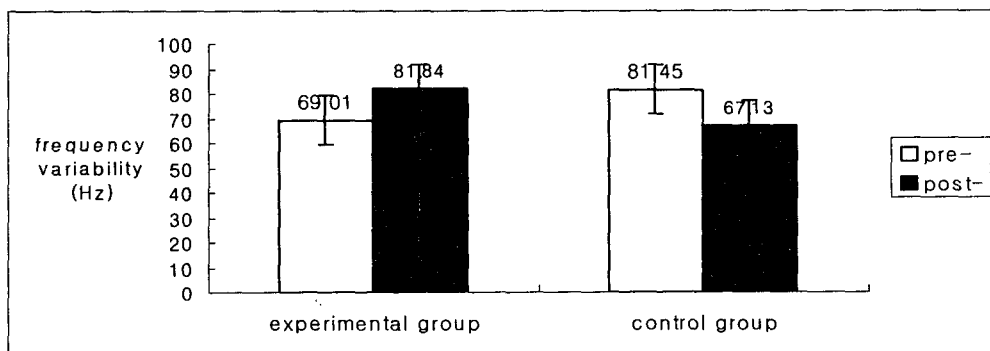


Figure 2. Frequency Variability Before and After the Therapy

The experimental group showed an increase of frequency variability from 69.01Hz to 81.84Hz after the therapy.

On the other hand, the control group showed a decrease of frequency variability from 81.45Hz to 67.13Hz after the therapy.

Table 8 showed the results of the Paired t-test on mono-pitch.

Table 8. Paired t-test on mono-pitch

group	t	p
experimental group (n=3)	-7.638	0.017*
control group (n=3)	1.508	0.271

* $p < .05$

The mono-pitch of the experimental group was significantly increased ($p < .05$). However, mono-pitch of the control group made no difference.

Mono-loudness

Table 9 and Figure 3 illustrated the improvement of intensity variability before and after the therapy.

Table 9. Intensity Variability

group	time of assessment	mean (dB)	SD (dB)
experimental group	pre-	15.04	2.48
	post-	20.83	2.91
control group	pre-	11.69	4.95
	post-	9.72	3.82

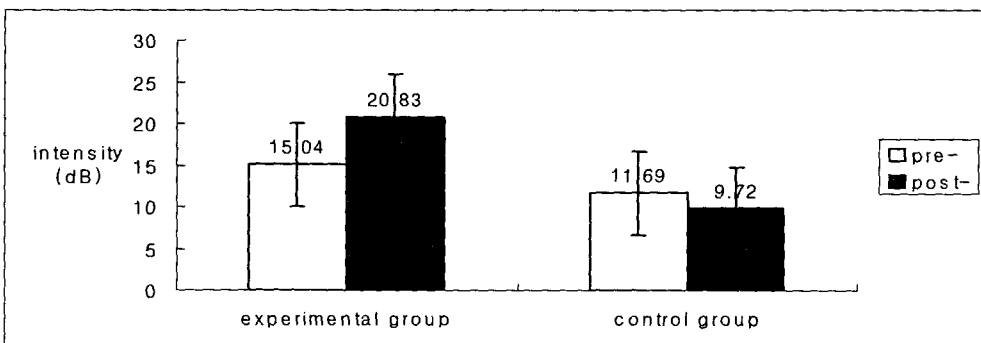


Figure 3. Intensity Variability Before and After the Therapy

The experimental group showed an increase of intensity variability from 15.04 dB to 20.83 dB after the therapy.

On the other hand, the control group showed a decrease of intensity variability from 11.69 dB to 9.72 dB after the therapy.

Table 10 showed the results of the Paired t-test on mono-loudness.

Table 10. Paired t-test on mono-loudness

group	t	p
experimental group (n=3)	-5.973	0.027*
control group (n=3)	2.765	0.110

* $p < .05$

The mono-loudness of the experimental group was significantly increased ($p < .05$). However, the mono-loudness of the control group made no difference.

Table 11 showed the results of the independent sample t-test on mono-loudness.

Table 11. Independent Sample t-test on mono-loudness

parameter	t	p
mono-loudness	4.009	0.016*

* $p < .05$

There was a significant difference between the 2 groups ($p < .05$).

Quality

Table 12 illustrated the improvements of voice quality after the therapy.

Table 12. Voice Quality

group	time of assessment	Jitter (%)		Shimmer (%)		HNR (dB)	
		mean	SD	mean	SD	mean	SD
experimental group	pre-	0.910	0.581	5.112	2.024	14.631	3.244
	post-	0.498	0.036	3.707	1.038	18.712	1.292
control group	pre-	0.386	0.032	3.199	1.424	18.126	1.272
	post-	0.927	0.482	5.017	0.890	12.554	0.747

The 3 parameters (jitter, shimmer, and HNR) of the experimental group showed improvements. However, the 3 parameters of the control group showed no improvement.

Table 13 showed the results of the Paired t-test on voice quality.

Table 13. Paired t-test on Voice Quality

group	Jitter (%)		Shimmer (%)		HNR (dB)	
	t	p	t	p	t	p
experimental group (n=3)	1.282	0.328	0.818	0.499	-2.833	0.105
control group (n=3)	-2.073	0.174	-4.392	0.048*	17.900	0.003*

* $p < .05$

The 3 parameters of the experimental group made no difference ($p > .05$). However, the shimmer and HNR of the control group made a difference.

Table 14 showed the results of the independent sample t-test on voice quality.

Table 14. Independent Sample t-test on Voice Quality

parameter	Jitter (%)		Shimmer (%)		HNR (dB)	
	t	p	t	p	t	p
Voice Quality	-1.538	0.199	-1.659	0.172	7.148	0.002*

* $p < .05$

There was a significant difference on HNR between the 2 groups ($p < .05$).

4. Conclusion

This study was conducted to determine the effects of the application of the Korean traditional rhythm therapy program which was a variation of the Accent Method in patients with Parkinson's disease.

The results of the study were as follows;

First, the MPT was increased significantly after therapy ($p < .05$). It seemed that respiratory problems of the patients were improved through breathing exercises. That was consistent with the results of the studies by Kwon (2001) and Pyo (1997) reported improvements in MPT following the application of the Accent Method. Second, the frequency variability was significantly increased ($p < .05$). It meant that the therapy improved mono-pitch of the patients.

On the other hand, the control group showed a decrease of frequency variability. That might be due to the degenerative nature of the Parkinson's disease. One of the major symptoms of Parkinson's disease, the reduction of frequency range has been known to be associated with rigidity of cricothyroid muscle (Lee et al., 2001). The Korean traditional rhythm therapy program could have improved the rigidity of the cricothyroid muscle, and increased frequency variability, and, in turn, brought improvements of mono-pitch.

Third, the intensity variability was significantly increased ($p < .05$). The control group showed a decrease of intensity variability. This might also be due to the degenerative nature of the disease. In addition, there was a significant difference between the 2 groups ($p < .05$). It meant that the therapy improved mono-loudness. That was consistent with the results of the study by Smith et al., (1976) which reported improvements in intensity following application of the Accent Method in 30 students. Therefore, the Korean traditional rhythm therapy program appeared to be effective in improving mono-loudness.

Finally, 3 acoustic parameters (jitter, shimmer, and HNR) of the experimental group showed improvements. However, the control group showed no improvement. There was a significant difference on HNR between the 2 groups ($p < .05$). Yang (2002) reported that the normal HNR measured by Praat in vowel /a/ was 20 dB. In this study, the HNR of the experimental group approached to 20 dB after the therapy. Therefore, Korean traditional rhythm therapy program was proved to be effective in improving voice quality of the patients with Parkinson's disease. That was consistent with the results of the study by Kwon (2001) which reported improvements in jitter, shimmer, and HNR following the application of Accent Method to voice disorder patients. The result was also consistent with the results of the studies by Khidr (2003) reporting improvement in voice quality following the application of Accent Method to the patients with vocal fold paralysis and Fex (1994) reporting improvements in jitter and shimmer following the application of the Accent Method to 10 functional dysphonic patients.

Therefore, it can be concluded that Korean traditional rhythm therapy program seemed to be effective in improving voice of Parkinson's disease patients.

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Appendix I. Rhythm Program

Therapy (Jinnyang rhythm)											
⊕				i		○				i	
Dung			Giduk		Duk Duk	Kung				Giduk	Duk Duk
○				-	-	○				○○	○○
Kung			Duk Duk-		Duk- Duk	Kung				Kung Kung	KungK ung
<ol style="list-style-type: none"> 1. The author and subjects hear the jinnyang rhythm. 2. After inhaling, the author produces the vowel /a/ to the jinnyang rhythm with tapping the knee. 3. The author proposes subjects to imitate the 2 activity. 4. The author produces vowels /a/, /e/, /i/, /o/, and /u/ to the jinnyang rhythm with tapping a small drum. 5. The author proposes subjects to imitate the 4 activity. 6. When familiar with the jinnyang rhythm, the author and subjects repeat the activities in turns. 7. The author produces non-meaning syllables to the jinnyang rhythm. 8. The author proposes subjects to imitate the 7 activity. 9. The author counts numbers to the jinnyang rhythm. 10. The author proposes subjects to imitate the 9 activity. 11. The author sing and humming with tapping the small drum to the jinnyang rhythm. 12. The author and subjects repeat the 11 activity. 											

Jungmori rhythm											
⊙				!	-	○				!	-
Dung		Duk		Duk	Duk-	Kung		Duk		Duk	Duk-
				Duh	Duk					Duh	Duk
Jungjungmori rhythm											
⊙			○			○			○		
Dung			Kung			Kung		Duk	Kung		
⊙			○			○			○		
Dung		Duk	Kung		Duk	Kung		Duk	Kung		Duk
⊙	.		○			○			○		○
Dung		Duk	Kung	Duk	Duk	Kung		Duk	Kung		Kung
⊙			○			○	○		○		○
Dung		Duk	Kung	Duk	Duk	Kung	Kung	Duk	Kung		Kung
Jajinmori rhythm											
⊙			⊙			⊙			⊙		
Dung			Dung			Dung			Dung		
⊙			○			○			○		
Dung			Kung			Kung			Kung		
⊙			○			○			○		
Dung			Kung			Kung		Duk	Kung		
⊙			○			○			○		
Dung		Duk	Kung	Duk		Kung		Duk	Kung	Duk	
Semachi rhythm											
⊙			⊙			⊙					
Dung			Dung			Dung					
⊙			⊙			○					
Dung			Dung		Duk	Kung					
⊙			⊙			○					
Dung			Kung		Duk	Kung		Duk			