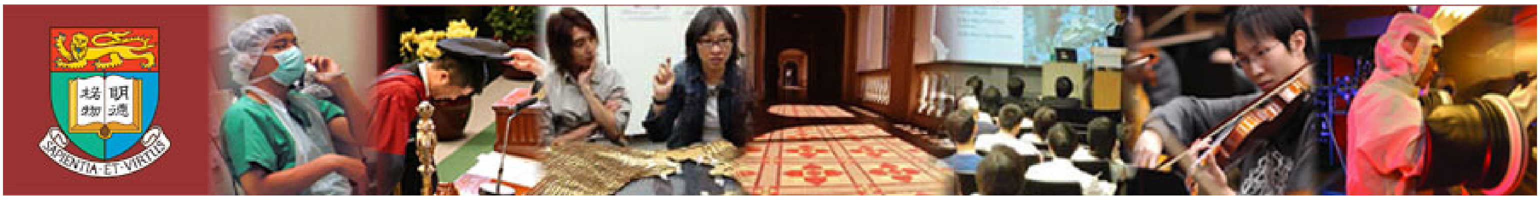

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Phonatory function under whole-body vibration in different vibratory frequencies and intensities

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A dissertation submitted in partial fulfilment of the requirements for the Bachelor of Science (Speech and Hearing Sciences), The University of Hong Kong, June 30, 2013.

Abstract

This study investigated phonatory function under whole-body vibration (WBV) in different frequencies and intensities. Twenty non-dysphonic adult volunteers and 2 additional volunteers for the pilot study were recruited for the study. They were exposed to a series of two vibrations: a "test" vibration and a "reference" vibration (set at 10 Hz, 25%) with a 2-s interval in between. The test vibration stimuli were set at 9 vibratory intensities (10% to 50% which varied in 5% steps) and 5 frequencies (5 Hz, 10 Hz, 15 Hz, 20 Hz, 25 Hz) combinations. Perceptual ratings of vibratory magnitude of the larynx and phonatory shakiness were rated using direct magnitude estimation (DME) scaling procedure. A 2 way repeated measures ANCOVA with body mass index (BMI) as a covariate revealed a significant effect of vibratory intensity, but not frequency, on the perceptual rating of phonatory shakiness. The present study revealed that greater phonatory shakiness was perceived at higher intensity level. However, another 2 way repeated measures ANCOVA with BMI as a covariate revealed no significant effect of vibratory intensity and frequency on perceived vibratory magnitude of the larynx.

Keywords: whole body vibration, phonatory function

Phonatory Function Under Whole-Body Vibration in Different Vibratory Frequencies and Intensities

Whole-body vibration (WBV) refers to transmission of vibration to the body through an oscillating plate (Cheung et al., 2007). Occupational exposure to WBV has first been considered a physiological hazard and therefore was studied to determine possible adverse effects on human bodies following operation of vehicles or operation of construction machinery (Jordan, Norris, Smith, & Herzog, 2005). Interestingly, a number of randomized controlled trials have demonstrated that WBV intervention has positive effects on muscle performance (Jordan et al., 2005; Prisby, Lafage-Proust, Malaval, Belli, & Vico, 2008).

Whole body vibration (WBV) was generally considered to be safe (Russo et al., 2003). Some mild and transient side effects were reported in some participants after WBV, including erythema, edema, headache, and itching of the legs or muscle soreness during the first sessions (Cheung et al., 2007; Rittweger, Beller, & Felsenberg, 2000; Roelants, Delecluse, & Verschueren, 2004; Rubin et al., 2004; Russo et al., 2003). Two participants with knee osteoarthritis who were overweight reported transient knee pain without objective clinical signs following WBV exercise (Russo et al., 2003). None of the above effects were considered serious.

The effect of WBV is known to be dependent on the frequency, magnitude, duration, and type of vibration (Griffin, 1996). Song, Kim, Lee, and Joo (2011) evaluated the effects of WBV on body composition of postmenopausal women. Comparison of body weight, waist circumference and muscle mass revealed significant decrease. Reduction in muscle mass was shown to be correlated with weight, body mass index (BMI), and percent body fat. Griffin (1996) suggested that the resonance frequencies vary with parts of the body, individual differences such as gender and weight, and body posture. High vibration magnitudes of greater than 2 ms^{-2} r.m.s. can be extremely uncomfortable (International Organization for Standardization, 1997).

Effect of the exposure to WBV on human larynx was first studied in the 1960-70s (Hoshino & Yokoyama, 1969; Yokoyama, & Hoshino, 1973). Yokoyama and Hoshino (1973) examined the effects of noise alone and noise with WBV on maximum voice intensity and maximum phonation time to study the Lombard effect. The participants were exposed to 5, 10, 15, and 20 Hz of vibration under two conditions: noise alone and noise with WBV. Maximum phonation time was reported to be shortened during simultaneous exposure to noise and WBV, especially at 10Hz and 5 Hz. They reported a significant increase in the maximum voice intensity during simultaneous exposure to noise and WBV when compared to exposure to noise alone. Increase in intensity was largest at 15 Hz, followed by 10 Hz, 20 Hz, and then 5 Hz. They attributed the resonant motion in the neck to the increased maximum voice intensity. This is consistent with the manufacturer's instructions for use that the neck region is stimulated by 15 Hz. On the other hand, the resonant body, especially the region of chest and abdomen, interrupted the expiratory flow of the breath, leading to a decrease in maximum phonation time.

In a comprehensive review by Prisby et al. (2008), WBV studies have been reported to improve the muscular strength of upper and lower body, elicit hormonal responses (e.g. growth hormone, cortisol, and testosterone), and increases cardiovascular responses. It is hypothesized that improving the strength and endurance of the sub-systems of voice may help to enhance vocal performance (Stemple, Glaze, & Klaben, 2000). Therefore, it is hypothesized that improvement in vocal performance with WBV may be shown.

The results of a study evaluating the acute responses of blood hormone concentrations and neuromuscular performance after WBV treatment showed a significant decrease in cortisol level (Bosco et al., 2000). Cortisol levels are indicative of a person's response to stress (Vinson, Whitehouse & Hinson, 2007). This decrease in the cortisol level may indicate a reduction in stress level. This reduced stress level may promote the relaxation of laryngeal muscles in phonation.

In summary, clinical studies suggest muscle strength and endurance can be improved by WBV (Jordan et al., 2005; Prisby et al., 2008). Yokoyama and Hoshino's (1973) study revealed both maximum phonation time and maximum voice intensity were affected by simultaneous exposure to WBV and noise. However, these studies did not investigate the effect of WBV per se on phonation. Clearly, there is a gap in existing literature that needs to be attended to. Besides, additional studies are needed to investigate about the optimal frequency and intensity to elicit maximal vibration on larynx. Therefore, the proposed study aims to evaluate the effect of different whole-body vibration frequencies (5 to 25 Hz) and intensities on phonatory function and vibration of the laryngeal muscles of healthy non-dysphonic adults with a within-subjects design. This study will contribute to the understanding of the effect of exposure to WBV on phonatory function. WBV has a great potential to be used as a new method for treating dysphonia. It is hypothesized that 15 Hz would elicit maximal vibration on larynx in all participants. Another hypothesis is that greater vibratory intensity might cause greater change in muscle performance, leading to more improvement shown in the participants exposed to longer duration of WBV.

General Method

Participants

The participants included twenty non-dysphonic adult volunteers (ten women, ten men) with a mean age of 22.05 years (*SD* = 1.58 years, range: 18–25 years) reported no history of voice disorders (see Table 1, for participant characteristics for the study). Written informed consent (see Appendix A, for consent form) was obtained from the participant prior to participation in the study. Two additional participants were recruited for the pilot study (see Table 2, for participant characteristics for the pilot study).

All participants were judged by themselves and the author to be free from any voice problems. Exclusion criteria are conditions that contraindicated WBV according to the manufacturer's instructions for use: any cardiovascular condition; musculoskeletal disease; pregnancy; pacemaker or other electrical implant; and epilepsy. Participants were not compensated for their participation. Ethics approval was obtained from the Faculty of Education Research Ethics Committee of the University of Hong Kong. Participants were asked to report immediately any discomfort or unusual symptoms (e.g. dizziness, fatigue) and the procedure would be terminated.

Table 1

Participant Characteristics for the Study

	Age (years)		Height (cm)		Weight (kg)		BMI (kg/m^2)	
Gender	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Male	21.85	1.45	171.40	6.08	63.43	8.79	21.62	3.08
Female	22.26	1.76	160.65	4.86	49.13	6.62	19.01	2.11
Sample	22.05	1.58	166.03	7.69	56.28	10.55	20.31	2.90

Table 2

Participant Characteristics for the Pilot Study

Subject	Gender	Age (years)	Height (cm)	Weight (kg)	BMI (kg/m^2)
A	Male	22	170.0	68.2	23.60
B	Female	26	160.5	50.5	19.60

Apparatus

WBV was performed by using the Turbosonic Vibration Therapy Trainer (Korea: TS

Korea Co., Ltd), which generates vertical sinusoidal wave with a variable frequency of 3 to 60 Hz. No intensity specifications were given; intensity of vibration can be selected from 0 to 99%. The display of the control panel was covered so that the participants were blinded to the frequency and intensity of vibration.

Stimuli

Since there are no published data available on the particular procedure to investigate phonatory function under WBV, a pilot study was done prior to data collection. In the pilot study, every participant was given a series of two vibrations: a "test" vibration and a "reference" vibration with a 2-s interval in between. In the pilot study, the test vibration stimuli were set at seven vibratory intensities (5% to 35% which varied in 5% steps) and five frequencies (5 Hz, 10 Hz, 15 Hz, 20 Hz, 25 Hz) combinations. The test vibration stimuli were presented in ascending order of intensity, giving a total of seven blocks. Each block consisted of a different randomization of 5 test vibration stimuli, which were in randomized order of frequencies (see Appendix B, for vibratory frequencies and intensities of pilot study test vibration stimuli). The reference vibration used vibratory intensity of 25% and frequency of 10 Hz. The duration of each vibration was 3 s, which was followed by 15 s rest period.

In the main study, there were two blocks of trials. Each of the blocks consisted of a different randomization of the test vibration stimuli. The test vibration stimuli were set at nine vibratory intensities (10% to 50% which varied in 5% steps) and five frequencies (5 Hz, 10 Hz, 15 Hz, 20 Hz, 25 Hz) combinations. A total of 90 test vibration stimuli were used (see Appendix C, for vibratory frequencies and intensities of test vibration stimuli). The reference vibration was the same as the one used in the pilot study, with vibratory intensity of 25% and frequency of 10 Hz . The duration of each vibration was 6 s, which was followed by 15 s rest period.

Perceptual Procedure

The method of direct magnitude estimation (DME) scaling procedure was used to obtain perceptual judgements for the pilot study and the study discussed below. Every participant was first given a series of two vibrations with a 2-s interval in between. The first vibration is the "reference" vibration which was given an arbitrary value of 100 on the DME scale. The participants and the examiner (author) then assigned each of the "test" vibration a number relative to the reference vibration. The participants were instructed to assign vibrations with vibratory magnitude of the larynx that are twice as that of reference vibration the value of "200." This scaling procedure was followed for both the rating of vibratory magnitude of the larynx, and rating of the phonatory shakiness.

The pilot study and the main study will be explained in detail below.

Pilot Study

The pilot study aims to test the proposed method for the main study to investigate phonatory function under WBV prior to data collection.

Design

The pilot study is a 5 × 7 design. The first independent variable (within-subjects variable), frequency, has five levels (5 Hz, 10 Hz, 15 Hz, 20 Hz, 25 Hz). The second independent variable (within-subjects variable), intensity, has seven levels: 5%, 10%, 15%, 20%, 25%, 30%, 35%.

Procedure

This study took place at the Voice Research Laboratory of the Division of Speech and Hearing Sciences, the University of Hong Kong. The whole procedure took approximately an hour to complete. Body height and weight were measured at the beginning of the study. The participants were required to remove any heavy clothing, loose jewellery, watches, and heavy items (e.g. belt) on their body before the study began. They wore only socks to prevent possible damping of vibration by shoes (Marín, Bunker, Rhea, & Ayllón, 2009). They were required to stand with normal erect position (knees slightly bent) on the oscillating instrument.

Participants were exposed to a 3-s reference vibration, and then a 2-s pause, followed by a 3-s test vibration. A 15-s rest period was given after each pair of stimuli. They were allowed to rest after 20 pairs of stimuli. They were asked to produce a sustained /a/ during WBV. Each participant was asked to rate each vibration independently on the vibratory magnitude of the larynx perceived relative to reference vibration using DME scaling procedures. The examiner rated each sustained phonation independently on the phonatory shakiness perceived using DME scaling procedures.

Data Analysis

The perceptual ratings of each frequency-intensity combination were calculated by obtaining the average of the ratings. Correlations between the perceptual ratings were calculated by the Pearson product-moment coefficient.

Results

The participants wore similar clothing (shirt, dress, jeans) in the study. Tables 3 and 4 shows the mean perceptual rating of vibratory magnitude of the larynx and phonatory shakiness under WBV in different vibratory frequencies and intensities. Participant B reported dizziness after item 25 and the procedure was terminated. Therefore, only the perceptual rating of participant A was reported in Tables 3 and 4 from items 26 to 30.

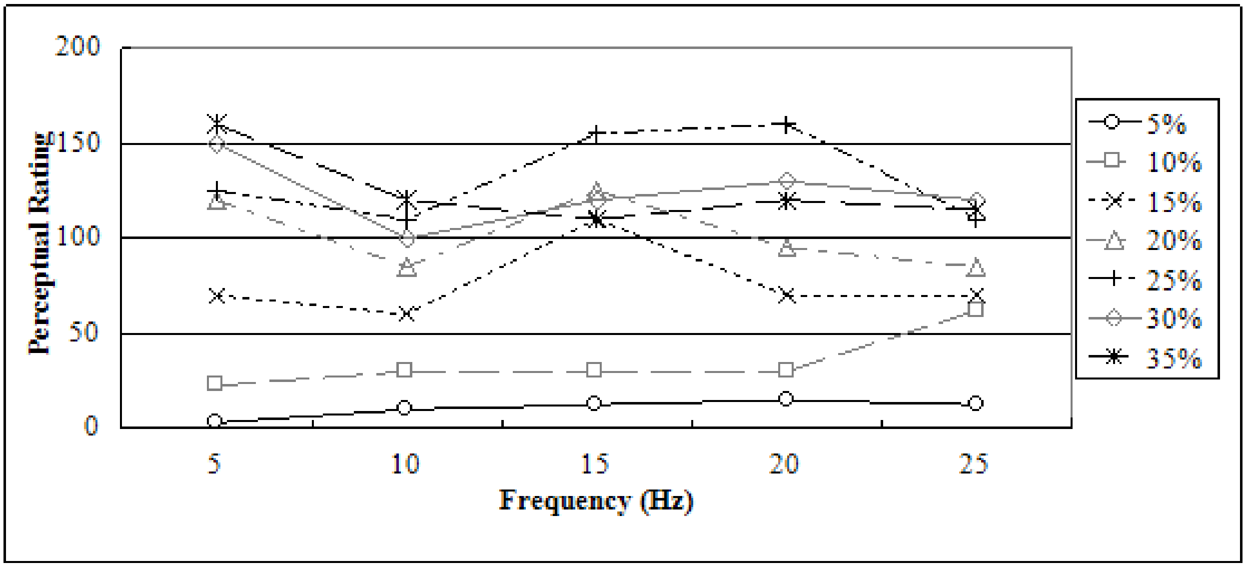

Figure 1. Mean perceptual rating of vibratory magnitude of the larynx in different frequencies and intensities. Mean perceptual rating of vibratory magnitude of the larynx were lower for 5% intensity.

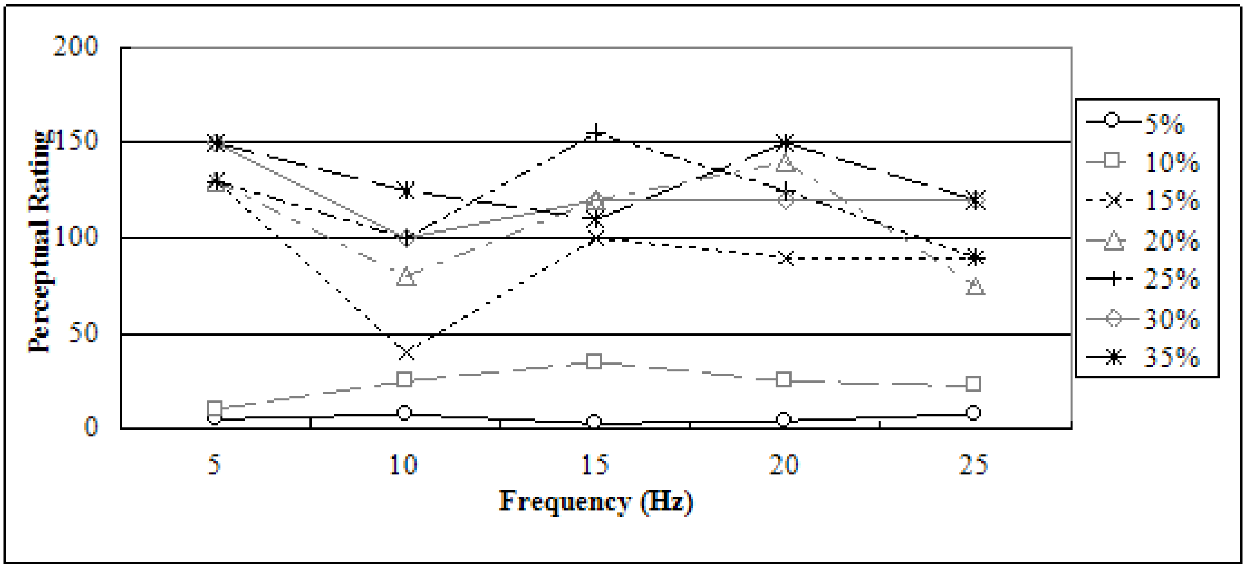

Figure 2. Mean perceptual rating of phonatory shakiness in different frequencies and intensities. Mean perceptual rating of phonatory shakiness were lower for 5% intensity.

Both mean perceptual rating of vibratory magnitude of the larynx and phonatory shakiness were lower for 5% intensity across the frequencies. For the vibration at 10 Hz and 25%

intensity, the perceptual ratings were close to or at 100. There was a significant relationship between the perceptual rating of vibratory magnitude of the larynx and perceptual rating of phonatory shakiness, $r = .89$, p (one-tailed) < .001. Both participants reported perception of transient acceleration of the vibration therapy trainer which had an impact on their perceptual rating.

Discussion

The dizziness reported by participant B was hypothesized to be due to inadequate rest periods. Therefore, more rest periods were included in the data collection of the main study. Since the study aimed to investigate about the optimal frequency and intensity to elicit maximal vibration on larynx, 5% intensity was not included in the stimuli of the main study because both its perceptual rating of vibratory magnitude of the larynx and phonatory shakiness were low. Number of levels of the intensity would be increased in the main study by including vibrations with higher intensity.

As expected, the perceptual ratings were close to or at 100 for the test vibration at 10 Hz and 25% intensity because its frequency and intensity was the same as the reference vibration. The transient acceleration of the vibration therapy trainer may alter the perception of vibratory magnitude and phonatory shakiness. To minimize this effect, the participants were instructed to disregard the first 3 s of both the reference and test vibration in the main study. Besides, in the main study, they were asked to produce a sustained /a/ after the vibration was presented to them for 3 s. Besides, the test vibration stimuli were presented in ascending order of intensity in the pilot study. To balance practice effects, both the stimulus frequencies and intensities were randomized in the main study.

Main Study

Design

The main study is a 5 × 9 design. The first independent variable (within-subjects variable), frequency, has five levels (5 Hz, 10 Hz, 15 Hz, 20 Hz, 25 Hz). The second independent variable (within-subjects variable), intensity, has nine levels: 10%, 15%, 20%, 25%, 30%, 35%, 40% , 45%, 50%.

Procedure

The same apparatus were used in the main study. The procedure was similar to the one in the pilot study, except the following modifications. First, the participants were allowed to rest after 10 pairs of stimuli. Besides, they were asked to disregard the first 3 s of both the reference and test vibration during perceptual rating. They were also required to produce a sustained /a/ only after the vibration was presented to them for 3 s.

Data Analysis

All analyses will be performed with SPSS software. The mean perceptual rating of vibratory magnitude of the larynx and phonatory shakiness of each participant will be calculated. Two-way repeated measures analysis of variance (ANOVA) was used. The test was carried out to compare 1) self-perceptual rating of vibratory magnitude of the larynx; and 2) perceptual rating of the phonatory shakiness in different frequencies and intensities. The overall significant level of $p < 0.05$ was used for all comparisons. The assumption of sphericity was tested by Mauchly's test. Bonferroni correction was employed for multiple comparisons. Since it was shown in previous research that the effect of WBV was correlated with BMI, two-way repeated measures analysis of covariance (ANCOVA) with BMI as a covariate was used to partial out its effect. Correlations between the two perceptual ratings and intrarater reliability of the two perceptual ratings were calculated by the Pearson product-moment coefficient.

Results

The participants wore similar clothing (e.g. t-shirt, jeans) in the study. All participants completed all the trials.

Statistical analyses of perceptual rating of vibratory magnitude of the larynx.

Mauchly's test was significant, revealing that the assumption of sphericity had been violated for the main effects of frequency $\chi^2(9) = 114.63$, $p < .001$, and intensity, $\chi^2(35) = 362.53$, $p < .001$. Therefore degrees of freedom of frequency and intensity were corrected using Greenhouse–Geisser estimates of sphericity ($\varepsilon = .29$ for the main effect of frequency and .14 for the main effect of intensity). After Greenhouse adjustment of degrees of freedom, the two-way repeated measures ANOVA revealed significant main effect of frequency, $F(1.17, 22.26) = 7.86$, $p = .008$, and significant main effect of intensity, $F(1.11, 21.03) = 13.59$, $p = .001$. The interaction effect between the frequency and intensity used was also significant, $F(32, 608) = 2.12$, $p < .001$.

After covarying for BMI, Mauchly's test revealed that the assumption of sphericity had been violated for the main effects of frequency $\chi^2(9) = 109.63$, $p < .001$, and intensity, $\chi^2(35) = 342.57$, $p < .001$. Therefore degrees of freedom were adjusted with Greenhouse–Geisser estimates of sphericity ($\varepsilon = .29$ for the main effect of frequency and .14 for the main effect of intensity). After Greenhouse adjustment of degrees of freedom, there was no significant effect of frequency $F(1.17, 21.03) = .67$, $p > .05$ and no significant effect of intensity $F(1.11, 19.9) = 1.51$, $p > .05$. The interaction effect between the frequency and intensity used were also non-significant, $F(32, 576) = .54$, $p > .05$. The covariate, BMI, was not significantly related to the rating, $F(1, 18) = .69$, $p > .05$.

Statistical analyses of perceptual rating of phonatory shakiness. Mauchly's test was significant, indicating that the assumption of sphericity had been violated for the main effects of frequency $\chi^2(9) = 54.68$, $p < .001$, and intensity, $\chi^2(35) = 115.55$, $p < .001$. Therefore degrees of freedom of frequency and intensity were corrected using Greenhouse–Geisser estimates of sphericity ($\varepsilon = .42$ for the main effect of frequency and .29 for the main effect of intensity). The two-way repeated measures ANOVA revealed significant main effect of frequency, $F(1.67, 31.76) = 42.93$, $p < .001$, and significant main effect of intensity, $F(2.34, 44.49) = 176.62$, $p < .001$, following Greenhouse adjustment of degrees of freedom. The interaction effect between the frequency and intensity used were also significant, $F(32, 608) = 8.58$, $p < .001$.

After covarying for BMI, Mauchly's test revealed that the assumption of sphericity had been violated for the main effects of frequency $\chi^2(9) = 53.17$, $p < .001$, and intensity, $\chi^2(35) = 112.44$, $p < .001$. Therefore degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity ($\varepsilon = .41$ for the main effect of frequency and .28 for the main effect of intensity). After Greenhouse adjustment of degrees of freedom, there was no significant effect of frequency $F(1.62, 29.20) = 1.75$, $p > .05$. and no significant interaction effect between the frequency and intensity $F(32, 576) = 1.21$, $p > .05$. The covariate, BMI, was not significantly related to the rating, $F(1, 18) = .381$, $p > .05$. However, the main effect of intensity was significant, $F(2.24, 40.28) = 4.67$, $p = .012$ (see Figure 3, for adjusted mean perceptual rating of phonatory shakiness in different vibratory frequencies and intensities). Post-hoc comparisons were used to follow up this finding. A Bonferroni correction was applied and all effects are reported at a .017 level of significance. The difference between the perceptual rating at the intensity of 20% and 25%, 30% and 35%, and 40% to 45% were not significant.

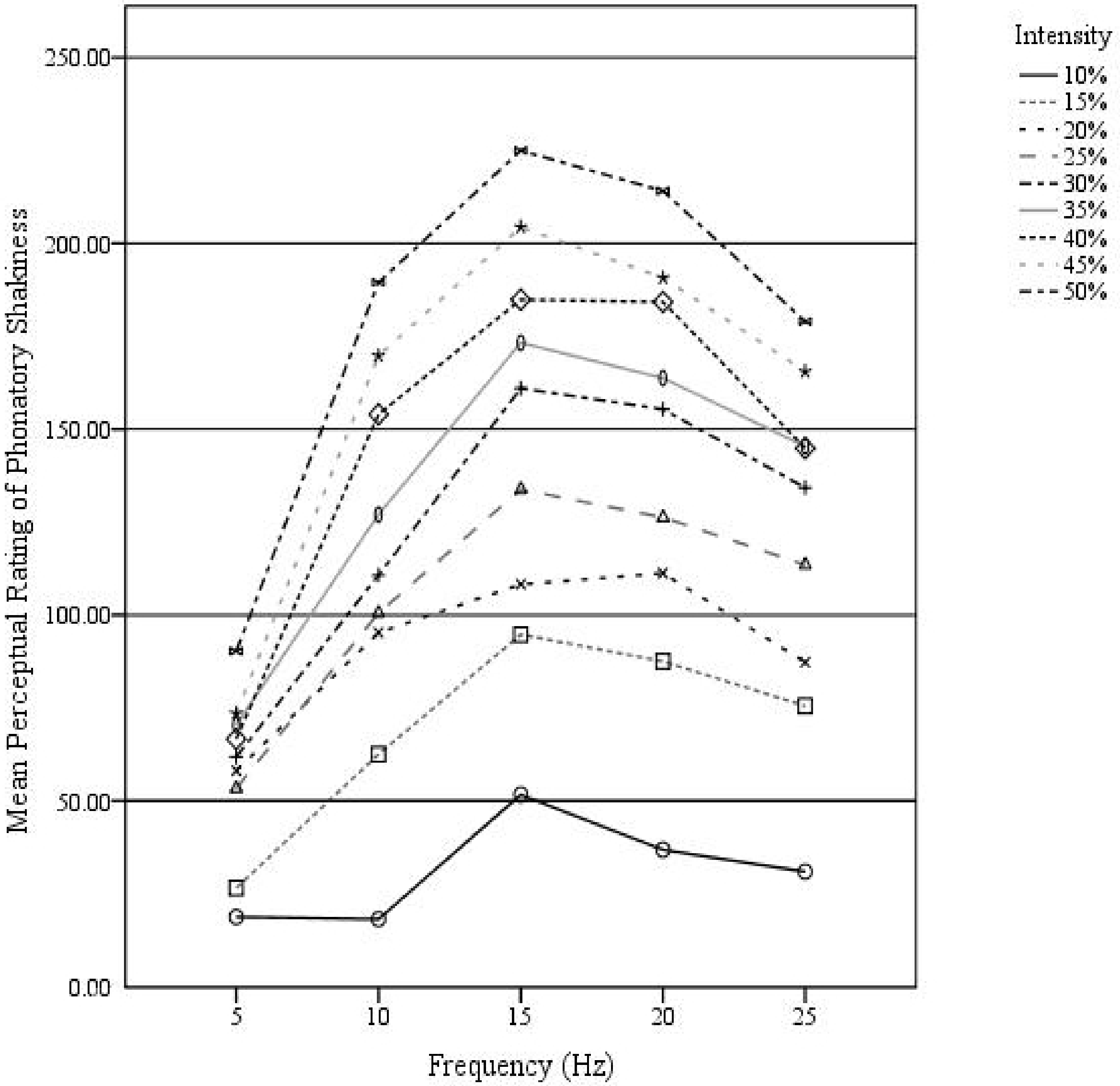

Figure 3. Adjusted mean perceptual rating of phonatory shakiness in different vibratory frequencies and intensities. Covariates appearing in the model are evaluated at BMI = 20.31.

Reliability of the procedure. The intrarater reliability coefficient of the participants was $r = .85$, p (one-tailed) < .01 (see Figure 4, for correlation between perceptual rating of vibratory magnitude). The intrarater reliability coefficient of the examiner was $r = .89$, p (one-tailed) < .01 (see Figure 5, for correlation between perceptual rating of phonatory shakiness). There was a significant relationship between the perceptual rating of vibratory magnitude of the larynx and perceptual rating of phonatory shakiness, *r* = .55, *p* (one-tailed) < .001 (see Figure 6, for correlation between perceptual rating of phonatory shakiness and perceptual rating of vibratory magnitude of larynx.)

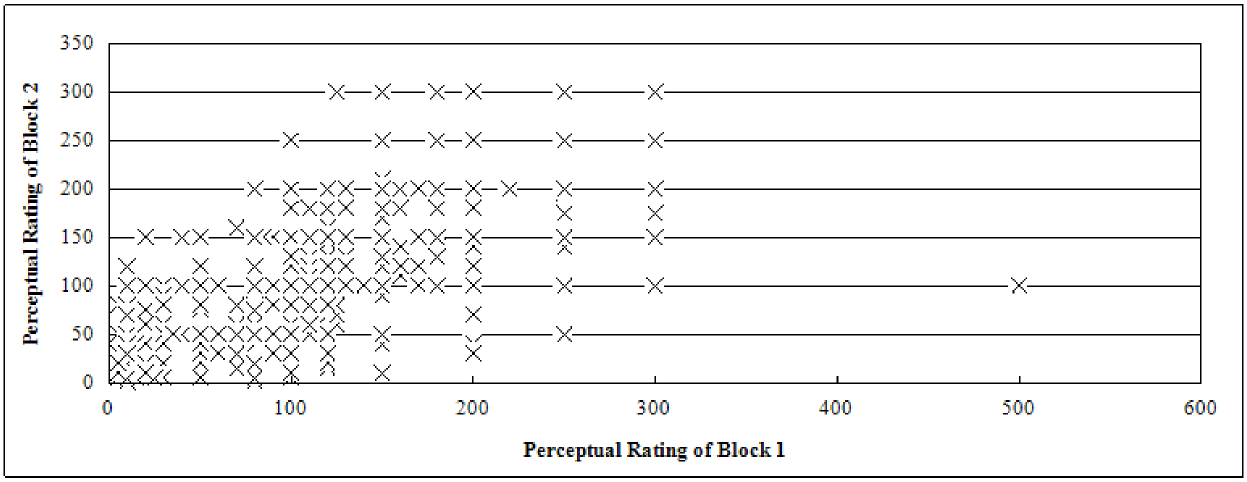

Figure 4. Correlation between perceptual rating of vibratory magnitude of larynx.

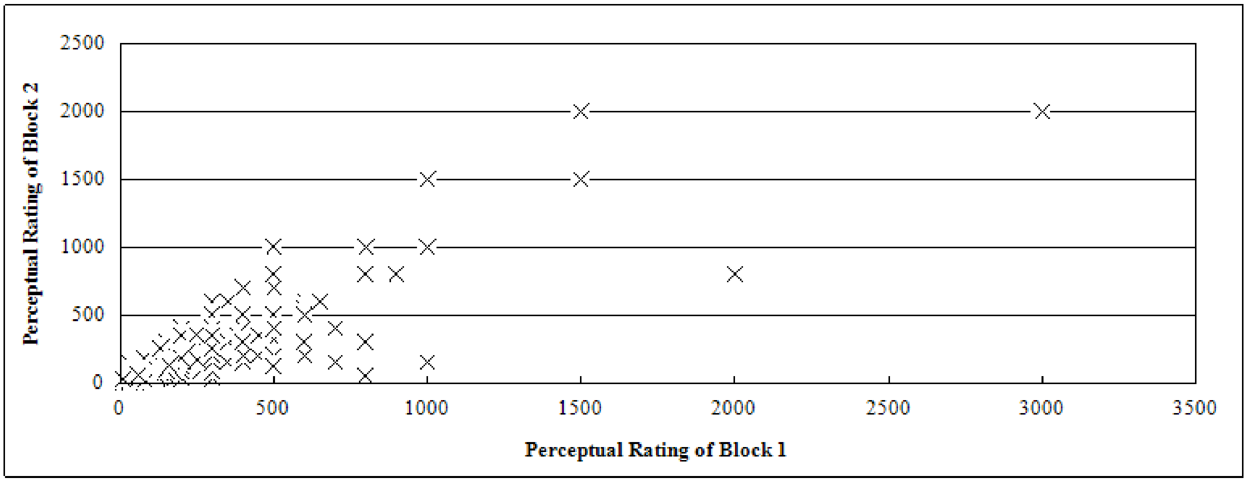

Figure 5. Correlation between perceptual rating of phonatory shakiness.

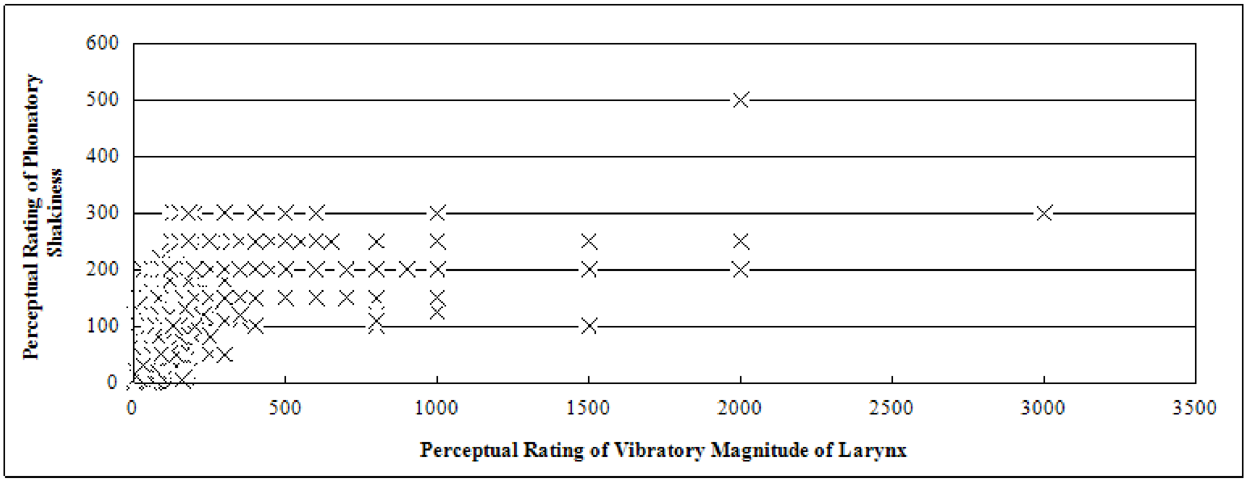

Figure 6. Correlation between perceptual rating of phonatory shakiness and perceptual rating of vibratory magnitude of larynx.

Discussion

The present study aims to investigate the phonatory function under WBV in different vibratory frequencies and intensities. This objective is achieved as the findings of the present study contribute to the understanding of perception of vibratory magnitude of the larynx and phonatory shakiness under WBV. The results suggest that phonatory function under whole body vibration is affected by intensity, which was expected as this might cause greater change in muscle activity. The present study revealed that the rating of phonatory shakiness was greater at higher intensity. Vibration with intensity set at 50% was found to have highest average perceptual rating of phonatory shakiness among the intensities of 10% to 50%. This intensity has the potential to be used for future investigation under WBV.

Contrary to the suggestion of Yokoyama and Hoshino (1973) that 15 Hz would elicit maximal vibration on larynx in the participants, there was no significant effect of frequency on the phonatory function of the participants, although highest average perceptual rating was observed to be found at 15 Hz among the different frequencies from 5 Hz to 25 Hz. This may be due to differences between the design of the present study and their study. Their study aimed to investigate the Lombard effect and did not investigate the effect of WBV per se on phonatory function. Another possible reason is that the chosen outcome measures (perceived vibratory magnitude of the larynx and phonatory shakiness) were not sensitive to the effect of WBV on phonation.

Good intrarater reliability was seen in the perceptual rating of vibratory magnitude of the larynx and phonatory shakiness. There was a statistically significant correlation between these two perceptual rating, indicating that both ratings measure the same trend of change in phonatory function under WBV across all participants. The perceptual rating of phonatory shakiness was considered a better outcome measure than perceptual rating of vibratory magnitude because the perceptual rating of phonatory shakiness was able to reveal the effect of intensity of vibration on phonatory function while perceptual rating of vibratory magnitude could not. The perceptual rating of phonatory shakiness may be a more sensitive outcome measure to detect change in phonatory function during WBV.

Limitations

There are several limitations in the present study. A major limitation of the study was the sample size. The sample only consisted of participants with a narrow range of age, height, weight, and BMI. These results may only be applicable to young, healthy adults. Besides, this study only investigated the effects on phonatory function of the participants during WBV but did not investigate its effects after WBV. Additionally, only a limited range of intensity was investigated (10–50%). High vibratory magnitudes can be extremely uncomfortable to the participants. However, the effect of WBV on perceived discomfort was not known. Investigation on this effect can help to inform the choice of optimal intensity of WBV to be used in future studies. In addition, the present study only investigated the phonatory function under WBV with vibration of different vibratory frequencies and intensities but of the same duration. It is hypothesized that longer vibration duration might cause greater change in muscle performance, leading to more improvement shown in the participants exposed to longer duration of WBV.

Besides, only perceptual ratings was used in the study. A number of clinical researches on WBV employed electromyography to investigate the muscle activity during WBV (e.g. Bosco et al., 2000). Compared to perceptual ratings, instrumental measurement has the additional advantages of being objective, reliable, and precise. Another limitation was that the trials were not rated by another rater to evaluate how reliable is the perceptual rating of phonatory shakiness.

Conclusion and Future Directions

To conclude, vibratory intensity was found to have significant effect on the perceptual rating of phonatory shakiness but not on the perceptual rating of vibratory magnitude of the larynx. The perceptual rating of phonatory shakiness was considered a better outcome measure than perceptual rating of vibratory magnitude in the present study. Since WBV has a great potential to be used as a new method for treating dysphonia, future studies can investigate whether improvement in the phonatory function will be shown after exposure to WBV. Larger range of intensity can also be investigated. In addition, in order to investigate about the optimal WBV condition, study on the effect of WBV on perceived discomfort is necessary. Future research may also investigate the effect of different vibration durations on phonatory functions. Outcome measure of future research can include instrumental measurement, for instance, electromyography and phonetogram, to investigate the effects of WBV on phonation.

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Appendix A

Consent Form

THE UNIVERSITY OF HONG KONG
Division of Speech and Hearing Sciences

Whole-Body Vibration and Phonation

You are invited to participate in a research study conducted by Miss Pansy Wong, under the supervision of Professor Edwin Yiu in the Division of Speech and Hearing Sciences at the University of Hong Kong, as part of the program of the Bachelor of Science in Speech and Hearing Sciences (BSc(Speech)).

PURPOSE OF THE STUDY

This study examines the effect of whole-body vibration on the production of voice.

PROCEDURES

You will be invited to step on a machine which vibrate your whole body. You will be asked to rate on the degree of vibration felt during the whole-body vibration. The task will be completed at the Voice Research Laboratory of the Division of Speech and Hearing Sciences, the University of Hong Kong. The whole procedure will take approximately an hour. You will be audiotaped/videotaped during the procedure.

POTENTIAL RISKS / DISCOMFORTS AND THEIR MINIMIZATION

Usually there is no discomfort in this procedure. Occasionally, you may experience some mild fatigue or dizziness during the procedure. Such fatigue and/or discomforts will be kept to a minimum and the procedure will be stopped if you experience any discomfort.

POTENTIAL BENEFITS

There are no direct benefits to you. However, the research project can provide valuable information on the effect of whole-body vibration on the production of voice. This information in turn could help inform future treatment of voice disorders.

CONFIDENTIALITY

Any information obtained in this study will remain very strictly confidential, will be known to no-one, and will be used for research purposes only. Codes, not names, are used on all test instruments to protect confidentiality. The research data collected (including audio/video-recording) will be stored in the Voice Research Laboratory of the Division of Speech and Hearing Sciences, the University of Hong Kong.

You can review the audio/video-recording of the procedure. We will erase the entire audio/videotape or parts of it if you want us to do so on completion of the project.

PARTICIPATION AND WITHDRAWAL

Your participation is voluntary. This means that you can choose to stop at any time without negative consequences.

STORAGE OF DATA

For research purposes, your participation will be audio/video-taped for further data checking. The data collected will be stored electronically (password protected) in the Voice Research Laboratory of the Division of Speech and Hearing Sciences, the University of Hong Kong. The record will be disposed of 5 years after publication of the relevant research results.

QUESTIONS AND CONCERNS

If you have any questions or concerns about the research, please feel free to contact Miss Pansy Wong (Telephone: 9853-7408; Email: wpansy@hku.hk). If you have questions about your rights as a research participant, contact the Human Research Ethics Committee for Non-Clinical Faculties, HKU (2241-5267).

SIGNATURE

I ________________________________ (Name of Participant)

understand the procedures described above and agree to participate in this study.

_______________________________________ _____________________________

Signature of Participant Date

_______________________________________ _____________________________

Witness Date

Date of Preparation: November 9, 2012
HRECNCF Approval Expiration date:

Appendix B

Vibratory Frequencies and Intensities of Pilot Study Test Vibration Stimuli

Number	Frequency (Hz)	Intensity (%)
T1	15	25
1	10	5
2	5	5
3	20	5
4	15	5
5	25	5
6	5	10
7	25	10
8	10	10
9	20	10
10	15	10
11	25	15
12	15	15
13	5	15
14	10	15
15	20	15
16	15	20
17	20	20
18	25	20
19	5	20
20	10	20
21	20	25
22	10	25
23	15	25
24	25	25
25	5	25
26	25	30
27	15	30
28	20	30
29	5	30
30	10	30
31	15	35
32	20	35
33	10	35
34	25	35
35	5	35

Appendix C

Vibratory Frequencies and Intensities of Test Vibration Stimuli

Number	Frequency (Hz)	Intensity (%)	Number	Frequency (Hz)	Intensity (%)
T1	10	5	36	20	25
T2	15	25	37	10	40
1	10	5	38	5	15
2	5	5	39	25	40
3	20	5	40	25	45
4	15	5	41	25	20
5	25	5	42	10	25
6	5	10	43	15	40
7	25	10	44	15	20
8	10	10	45	25	10
9	20	10	46	10	25
10	15	10	47	15	50
11	25	15	48	20	25
12	15	15	49	20	50
13	5	15	50	5	25
14	10	15	51	15	10
15	20	15	52	10	10
16	15	20	53	5	20
17	20	20	54	25	15
18	25	20	55	25	30
19	5	20	56	10	50
20	10	20	57	15	25
21	20	25	58	25	45
22	10	25	59	25	35
23	15	25	60	10	20
24	25	25	61	25	50
25	20	25	62	25	25
26	25	30	63	25	40
27	15	30	64	20	15
28	20	30	65	25	10
29	5	30	66	5	35
30	10	30	67	15	45
31	15	35	68	25	20
32	20	35	69	5	15
33	10	35	70	20	35
34	25	35			
35	5	35			

(table continues)

Number	Frequency (Hz)	Intensity (%)	Number	Frequency (Hz)	Intensity (%)
71	10	35	81	10	45
72	5	40	82	20	45
73	15	35	83	10	30
74	20	20	84	5	10
75	15	40	85	5	50
76	5	45	86	20	30
77	10	40	87	20	10
78	5	30	88	15	30
79	15	15	89	15	20
80	10	15	90	20	40

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