Original Article

Vol. 12, No. 3, 171-177
https://doi.org/10.15280/jlm.2022.12.3.171

Journal of Lifestyle Medicine

Timed Vibration Sense and Joint Position Sense among Male University Students Experiencing Phantom Vibration Syndrome, Affecting Their Lifestyle

Rahul Kumar Singh[1], Vandana Esht[2,*], Aksh Chahal[1]

[1]Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation, Maharishi Markandeshwar (Deemed to be University) Mullana, Haryana, India, [2]Department of Physical Therapy, Faculty of Applied Medical Sciences, Jazan University, Jazan, Saudi Arabia

Background: Vibration dysfunction can cause a number of pathologies in the body, starting with the distal joints and swiftly progressing to proximal joints if not addressed. As a result, it's important to be aware of vibration dysfunction and syndromes like phantom vibration syndrome. The purpose of the following study was to determine if phantom vibration syndrome affects university male students' lifestyles in terms of vibration sensitivity and joint position sense.
Methods: A cross sectional study design with a total of 96 individuals were chosen on the basis of random sampling. Participants were assessed for potential phantom vibrations using a self-structured and validated questionnaire approved by clinical experts. Following the completion of questionnaire, the individuals timed vibration sense and Joint position sense were tested using a tuning fork (128 hz) and a full circle goniometer respectively.
Results: According to the results of the survey, 100% (96) of individuals experienced phantom vibrations, and 97.9% (94) of individuals assume their phone was ringing when it isn't. 56.3 % (54) of people become anxious due to phantom vibrations or ringing of phone. When current study's median value for timed vibration sensation (4 sec) was compared to previous studies, the results were found to be within normal ranges, implying that the phantom vibration syndrome had no physiological influence on timed vibration sense (VBS). In previous studies, the hip joint position sense average absolute error score decreased linearly from the target position. The reproduce angle from the target position reduced overall in the current study, indicating no change in joint position sense in people experiencing phantom vibration syndrome.
Conclusion: Phantom vibration syndrome effects individual psychologically but not physiologically.

Key Words: Anxiety, Cross-sectional, Proprioception, Physiological, Sensation

INTRODUCTION

"Humans are surrounded with vibrations". Vibrations can be detected by sensitive skin mechanoreceptors, but our conscious awareness of their presence is generally limited [1]. There are three fundamental categories of sensory receptors in our somatosensory system, each of which detects various forms of external stimuli [2]. Light touch, vibration, pressure, and texture are detected by mechanoreceptors [2]. Vibrations are sent to the primary somatosensory area of the

Received: July 12, 2022, Accepted: September 1, 2022

*Corresponding author: Vandana Esht
Department of Physical Therapy, Faculty of Applied Medical Sciences, Jazan University, P.O.Box.114, Jazan 45142, Kingdom of Saudi Arabia
Tel: 91-8059-930235, Fax: 91-07-3161788
E-mail: vandanaesht@jazanu.edu.sa

cortex via the dorsal column of the spinal cord. Proprioceptive sensation are the deep sensation responsible for the vibratory sense (pallesthesia), joint position sense (arthresthesia) and kinesthesia (perception of muscular movement) [3]. Vibration sensation is assessed at the distal joint first, rather than the proximal joint, because dysfunction manifests at the distal joint first. There are some diseases which lead to impaired joint position and absent jerks, hence effect the vibration sense of a normal individual. These disease are generally seen in diabetic patient and in alcoholic individual [3]. Phantom vibration syndrome is the sense of a mobile phone vibrating when it is not actually vibrating, phantom vibrations and ringing may be caused by the brain's ability to build new connections in reaction to changes in the environment, according to neuroplasticity theory [4]. Our mind or body tells us the phantom vibrations in belts, pockets, and even purses, which may be the consequence of actual nerve damage, a mental health issue, or both, according to an article published in the New Pittsburgh Courier in 2003 [5]. In the information era, electronic gadgets such as pagers and cell phones have become commonplace. Users regularly set electronic gadgets to "vibrate" mode in order to retain electronic access in quiet places. Using the electronic devices in vibration mode frequently, one may create the illusion that the device is vibrating when it isn't [6]. This phenomenon is called as "phantom vibration syndrome. According to studies, phantom vibration syndrome is strongly linked to stress. Phantom vibration syndrome can cause sleep problems in some people which further affects the daily living [7]. People with severe phantom ringing syndrome have been associated with cognitive and affective depression in some studies [8]. The study's aim was to determine if phantom vibration syndrome affects university male students' lifestyles in terms of vibration sensitivity and joint position sense in university male students aged 18 to 30 years.

MATERIALS AND METHODS

1. Ethical approval

The study was undertaken in accordance with the Helsinki Declaration (Revised 2013) and National Guidelines for Biomedical and Health Research involving human participants (Indian Council of Medical Research, 2017) and was approved by the student project committee of Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation (MMIPR) with Ethical approval No: MMIPR/SPC/41. Participants who met the study's eligibility requirements and were willing to participate were chosen. All participants signed a written informed consent acknowledging the conditions of the study.

2. Participants

To find the sample size for current study Cochran formula was used in which the confidence interval (z) was taken as 1.96, the population size was obtained from an article which gave the population percentage of 54.3% for the phantom vibration syndrome hence the p-value was obtained as 0.5 and the margin of error was taken on 10%. The calculate sample size was obtain N = 96. Participants were asked about how often they experienced phantom vibrations. Physical examination yielded their height and weight. Following the procedure's explanation timed vibration sense testing and joint position testing was performed. Students experiencing Phantom Vibration Syndrome were given a questionnaire. A self-structured and validated questionnaire asked 16 questions about potential parameters linked to phantom vibrations, such as age, position of keeping cellphone, and duration of mobile use. The study included male university students 18-30 years of the age experiencing phantom vibration. The exclusion criteria included: sensory deficit, females, neurological disorder, musculoskeletal disorder, any trauma and fractures.

3. Timed vibration sense testing

For timed vibration sense testing, a vibration stimulus was produced bilaterally at the distal metatarsophalangeal joint of the great toe, the medial malleolus, and the greater trochanter using a standardized tuning fork (128 Hz). The examiner struck the tuning fork against the palm of the free hand just firmly enough to cause the metal ends to collide, creating a metallic clanging sound. To avoid touching the vibrating tines, the examiner gripped the tuning fork stem with two fingers, akin to clutching a dart. A timer was used to record the start of the VBS and the end of the VBS [9].

4. Joint position sense

For Hip Joint: Firstly, the method was thoroughly explained and then subjects were allowed to lie down in supine position. The examiner secured the universal goniometer with a velcro strap, with the fulcrum at the greater trochanter, the stable arm parallel to the trunk, and the movable arm parallel to the femur (movable segment), and then passively positioned the limb in the target position (100°) before returning to the initial position. Repeat the same technique while blindfolded at the target position. The angle was calculated using a full circle goniometer, and the JPS was calculated. Three JPS readings were taken, and the average of the three readings was used to determine the normative value of hip joint position sense [10].

For Great Toe: Flexion and extension of the great toe were used to determine the JPS. The subjects were asked to detect and report the direction of movement after the great toe was lightly held at the sides with the thumb and index finger and moved up or down randomly by at least 20°. 10 trials were completed, with the number of accurate trials being recorded [9].

5. Statistics

Data were managed in Microsoft Excel 2016 (Microsoft corporation) and analyzed using SPSS 26 software (statistical package for the social sciences). Kolmogorov–Smirnov test of normality was used as the sample size was more than 50. As the data follow not normal distribution non parametric test (Wilcoxon signed rank test) of significance was use to find the p-value for JPS and VBS.

RESULTS

A total of 96 male students from a university were enrolled in a cross-sectional study. Demographic data of the participants present with a not-normal distribution. Demographics for age in years showed median of 21 with a 95% confidence interval of 8 ranging from 18 to 26 years, while the demographics for height, weight, and BMI showed a median of 167 cm (33), 60 kg (43), 21 kg/m^2 BMI (14.25) and ranges from minimum to maximum, i.e. 152-185 cm, 45-88 kg, and 17.3-31.5 kg/m^2 respectively.

1. Median value of timed vibration sense

Timed vibration sense among university male students were within the normal ranges 2-8 seconds which revealed no statistically significant differences in the great toe left and right, left leg medial and lateral malleoli, and greater trochanter left and right ($p > 0.050$) [9] (Table 1, Fig. 1).

2. Median value of joint position sense

For Hip Joint: The study established the median value of hip joint position sense among university male students which showed statistically significant for left hip joint side with eye open and close ($p < 0.050$) but showed statistically

Table 1. Median value for timed vibration sense test

Timed Vibration Sense	Median (IQR)	95% CI	p-value*
Great Toe Left	4.47 (3.58,5.40)	4.35 to 4.94	0.959
Great Toe Right	4.65 (3.73,5.36)	4.36 to 4.91	
Left Leg Medial Malleoli	4.64 (3.83,5.54)	4.49 to 4.95	0.392
Left Leg Lateral Malleoli	4.60 (3.73,5.33)	4.43 to 4.89	
Right Leg Medial Malleoli	4.71 (3.96,5.29)	4.52 to 4.95	0.206
Right Leg Lateral Malleoli	4.61 (3.96,5.17)	4.40 to 4.80	
Greater Trochanter left leg	3.85 (3.32,4.32)	3.74 to 4.03	0.798
Greater Trochanter right leg	3.70 (3.26,4.49)	3.70 to 4.07	

IQR: interquartile range, CI: confidence interval.
*Wilcoxon signed rank test.
Table 1 shows median value for time vibration sense test for the participants. Table shows no significant difference in between left and right great toe, left and right leg medial and lateral malleoli, left and right greater trochanter ($p > 0.050$). Right leg lateral malleoli median shows two outliers of 12 seconds giving a significant value of 0.037 ($p < 0.050$) when outliers were removed making the sample size 94 for the right leg lateral malleoli. The value showed a non-significant value of 0.206 ($p > 0.050$) for right leg lateral malleoli.

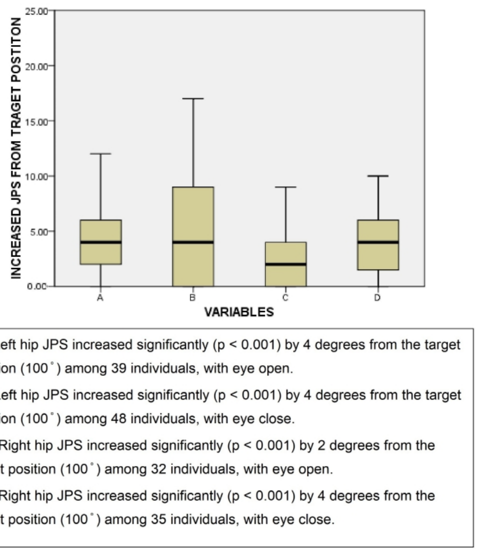

Fig. 1. The box plot represents the overall increase in the reproduce angle from the target position with median and interquartile range depicting significant joint position sense (JPS) score ($p < 0.001$) among individuals with eye open and eye close.

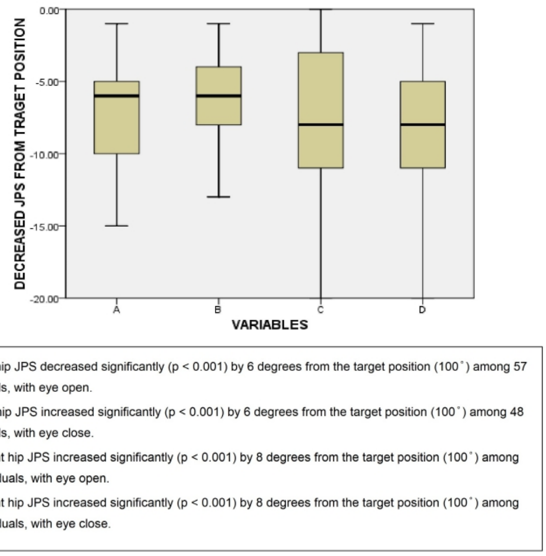

Fig. 2. The box plot represents the overall decrease in the reproduce angle from the target position with the median and interquartile range depicting significant joint position sense (JPS) score ($p < 0.001$) among individuals with eye open and eye close.

Table 2. Median value for joint position sense of hip joint

Joint Position Sense of Hip Joint	Median (IQR)	95% CI	p-value*
Left Hip Joint Eye Open	−2 (−3 to 6)	0.8, 3.6	0.002
Left Hip Joint Eye Close	−1 (−4 to 6)	−0.8, 1.9	
Right Hip Joint Eye Open	−3 (0 to 10)	2.45, 5.35	0.128
Right Hip Joint Eye Close	−3 (−2 to 10)	1.18, 4.63	

IQR: interquartile range, CI: confidence interval.
*Wilcoxon signed rank test.
Table 2 shows median value for joint position sense of hip joint. Negative median value represent the decrease in degree from target position. The table shows statistically significant difference ($p < 0.050$) between left hip joint eye open and eye close whereas it shows statistically nonsignificant difference between right hip joint eye open and close ($p > 0.050$).

non-significant for right hip joint side with eye open and close ($p > 0.050$) (Table 2, Fig. 2).

For The metatarsophalangeal Joint: The no. of trails for Joint position sense of great toe was performed and it showed statistically non-significant value for great toe left ang great toe right ($p > 0.050$).

3. Comparing p-value of hip joint position sense difference

When left hip joint with eye open and right hip joint with eye open were compared to hip joint of left side with eye close and hip joint of right-side eye with close, a statistically significant value of 0.008 ($p < 0.050$) was obtained.

4. Comparing p-value of timed vibration sense of left leg malleoli with right leg malleoli

On comparing timed vibration sensation of left leg medial malleoli with the right leg medial malleoli and the left leg lateral malleoli with the right leg lateral malleoli, results are 0.759 and 0.213, respectively, which is non-statistically significant ($p > 0.050$).

DISCUSSION

The goal of the present study was to determine, if phantom vibration syndrome affect lifestyle among university male students in terms of vibration sensitivity and joint position sense, as well as to analyze the physiological and psychological effects of the syndrome in the students.

According to the World Health Organization (WHO), the typical Body Mass Index (BMI) for the Asian population is 18.5-24.9 kg/m^2, and because the majority of individuals in our study had a BMI of 21 kg/m^2, thus are healthy and have good nutritional and physical health [11].

Phantom vibration and ringing syndrome's exact mechanism is unknown. Many explanations have been proposed to explain how Phantom syndrome developed. According to Signal Detection Theory (SDT), a mobile phone in one's pocket can be in one of the two states: ringing or not ringing. Human brain can also be in any one of two states: judgement that the phone is ringing or judgement that it isn't ringing. Obviously, the brain wants to accurately match these states. The statement "it's ringing" should be accompanied with true vibrations, while the statement "it's not ringing" should be accompanied with no vibrations. In SDT, these exact matches are referred to as "hits" and "correct rejections," respectively [4]. However, the brain could mismatch actual vibrations with "it's not ringing" (a "miss"), or the absence of vibrations with "it's ringing" (a "false alarm") i.e. Phantom vibration and ringing syndrome are caused by second type of mismatch [12]. Phantom vibrations and ringing may be attributed to brain's ability to build new connections in reaction to changes in the environment, according to neuroplasticity theory. When cellphone users are exposed to certain sensations on a frequent basis, such as vibrating, their brains develop accustomed to them. It's an illustration of how technological advancements are altering the way our brains process information. The current study's findings appeared to be the product of neuroplasticity [4].

As 92.7% (89) of people kept phones on right sides of their body, 91.7 % (88) experienced vibration on the same side. 97.9% (94) experienced feeling of phone ringing even when it wasn't. The survey also proposed that 56.8% (54) of people finding vibrations bothersome and 61.5% (59) experiencing them on daily basis whereas 32.3% (31) have experienced on weekly basis similar results were shown in a 2015 research where majority of students experienced Phantom syndrome symptoms on a monthly basis, while some on weekly or daily basis [4]. When the phone vibrates, however, 56.3% (54) of people become anxious. According to a study done earlier majority of participants reported experiencing phantom vibration hallucinations between first month and one year after purchasing a device [4]. Even the phone isn't in their pocket or turned off, 81.9% (77) of individuals felt vibrations. Findings from the present study indicating phantom Syndrome symptoms to be proportional to the number of hours the phone was carried [4] (Table 3).

Moving ahead with, according to findings, statistically nonsignificant differences ($p > 0.05$) were found in the values of VBS at great toes on both sides, the left leg lateral and medial malleoli, and the greater trochanter on both sides, but the right leg lateral malleoli median showed two outliers of 12 sec giving a significant value of 0.037 ($p < 0.050$) when the outliers were removed making the sample size 94 for the right leg lateral malleoli. It showed a nonsignificant value of 0.206 ($p > 0.050$) (Table 1). Because the data was not normally distributed, the p-value was calculated using the nonparametric Wilcoxon signed rank test. In a previous study the normative value for timed vibration sensing (VBS) in the age group of 18-29 was determined and according to the study, the normative value moving further, JPS of the hip joint and the metatarsophalangeal joint were evaluated using a full circle goniometer to calculate the angle and JPS difference. According to present study, the median with (95% CI) was used to calculate the normative value of hip joint position sense; for left hip joint eye open overall sample size (N = 96) decreased by 2 degrees from the target position (100°) and for left hip joint eye close overall sample decreased by 1 degree from the target position whereas for right hip joint open and closed, there was a decrease of 3 degree from the target position (Table 2). The study also showed that the hip joint position sense had a statistically significant value in left hip joint eye open and close ($p < 0.050$), but a statistically nonsignificant value in right hip joint eye open and close ($p > 0.050$). According to Adams, the closed loop theory of motor learning is required for error correction and the formation of the perceptual trace. This perceptual trace is the combination of instantaneous feedback on the limb's momentary position, information about the recent movement's error, and references to previous movements of the same limb [13]. Despite

Table 3. Frequency distribution of responses to questions on phantom vibrations syndrome (N = 96)

No. of mobile phone own	Frequency	%
1 mobile phone	87	90.6
2 mobile phones	9	9.4
3 mobile phones	0	0
More than 3 mobile phones	0	0
Duration of mobile phone usage		
About a year	4	4.2
More than a year	5	5.2
More than 2-3 years	36	37.5
More than 5 years	51	53.1
Time spent on phone in a day		
Less than 1 hour	9	9.5
1-3 hours	15	15.8
3-6 hours	41	43.2
6-12 hours	30	31.6
Side mobile phone are placed		
Right	89	92.7
Left	7	7.3
Feeling of phone ringing when it isn't		
Yes	94	97.9
No	2	2.1
Finding it bothersome		
Yes	54	56.8
No	15	15.8
Maybe	26	27.4
Feeling of phone vibrating when it isn't		
Yes	94	97.9
No	2	2.1
Times phone vibration experienced		
Daily	59	61.5
Weekly	31	32.1
Monthly	6	6.3
Feeling of vibration when phone isn't in the pocket or switched off		
Yes	77	81.9
No	17	18.1
Personal information on phone		
Yes	91	94.8
No	5	5.2
Frequency of changing mobile phone		
Every week	5	5.2
Every month	1	1
Every year	49	51
Always the same phone	41	42.7
Purpose of using mobile phone		
Messages and calls	50	52.1
Social media	12	12.5
Games	10	10.4
Internet surfing	17	17.4
Other application	7	7.3

Table 3. Continued

No. of mobile phone own	Frequency	%
Duration of keeping mobile phone in pocket		
Yes	3	3.1
No	0	0
3 hours	6	6.3
6 hours	62	64.6
All day	25	26
Site of keeping phone		
Jeans front pocket	93	97.9
Shirt Pocket	0	0
Jeans Back Pocket	0	0
Backpack	0	0
Others	2	2.1
Site of feeling vibration		
On the same side of the body as that of the phone	88	91.7
On the opposite side of the body as that of the phone	1	1
On both sides of the body	7	7.3
Other	0	0
Feel anxious wile mobile phone vibrates		
Yes	54	56.3
No	11	11.5
Maybe	18	18.8
At times	13	13.5

the fact that in our study, the feedback visual clue (target position) was the same for both eye open and eye close, per ceptual trace of both hip JPS eye open and eye close was different, implying that the left side's motor learning ability is reduced. This could be due to the majority of individual's left side to be their non-dominant side. The study also reveals the participants degrees of deviation from the target position, which were denoted as increasing or decreasing. The JPS hip joint comparison for closed and open eyes on the right and left side both yielded a statistically significant value of 0.008 ($p < 0.050$). The reason for this could be the Adams closed loop theory of motor learning, which explains the perceptual trace, and in our study, the joint position sense in eye open and eye closure exhibits different values due to the dominance and non-dominance factor of right and left sides [13]. The median with Interquartile range was used to calculate the normative value of joint position sensation of the great toe. The median JPS for both the right and left great toes was 10 (based on the number of trails) and the IQR was 10,10. The JPS great toe had a p-value of 0.564 ($p > 0.050$), which was statistically nonsignificant. A previous study found that JPS testing at the great toe, with 2 or more errors in a 10 trial, is an effective test for ruling out DSP [9].

Limitations of the study are (1) Based on the current sample, the findings are unlikely to extend to other young individuals from different subcultures as it was single centred study. (2) The study was not to define and understand every aspect of the phantom vibration syndrome, but rather to begin to study the frequency of phantom vibrations syndrome and the components that relate to phantom vibration syndrome in a population with a high rate of mobile phone usage. (3) The placement of tuning fork and goniometer over the assessed area may vary because of unavoidable human error

CONCLUSION

The present study concludes, Phantom vibration syndrome to have psychological effect in context to timed Vibration Sense (VBS) and Joint Position Sense (JPS), but not physiological. The study proposed, phantom vibration syndrome to affect psychologically, as 56.3% (54) of people get anxious when their phone vibrates affecting their life style. Thus it's important to educate people about phantom vibration syndrome.

CONFLICTS OF INTEREST

None to declare.

REFERENCES

1. Oroszi T, van Heuvelen MJG, Nyakas C, van der Zee EA. Vibration detection: its function and recent advances in medical applications. *F1000Res* 2020;9:F1000 Faculty Rev-619.
2. Bajwa H, Khalili YA. Physiology, vibratory sense. StatPearls Publishing, USA. 2022.
3. Walker HK, Hall WD, Hurst JW, editors. Clinical Methods: The History, Physical, and Laboratory Examinations. (3rd ed). Butterworths: Boston (MA). 1990.
4. Goyal AK. Studies on phantom vibration and ringing syndrome among postgraduate students. *Indian J Community Heal* 2015;31;27(1):35-40.
5. Sunitha V, Rajesh R, Aruna J. Assessment on prevalence and its factors on phantom vibration syndrome among UG and PG students in selected colleges. *J Edu Technol Health Sci* 2020;7(3):90-5.
6. Rothberg MB, Arora A, Hermann J, Kleppel R, St Marie P, Visintainer P. Phantom vibration syndrome among medical staff: a cross sectional survey. *BMJ* 2010;341:c6914
7. Setianingrum AY. Hubungan Phantom Vibration Syndrome Terhadap Sleep Disorder dan Kondisi Stress. *J Optimasi Sist Ind* 2017;16(2):158.
8. Lin YH, Chen CY, Li P, Lin SH. A dimensional approach to the phantom vibration and ringing syndrome during medical internship. *J Psychiatr Res* 2013;47(9):1254-8.
9. Prabhakar A, Suresh T, Kurian D, Mathew V, Ahmed Shaik A, Aaron S, Sivadasan A, Benjamin RN, Alexander M. Timed vibration sense and joint position sense testing in the diagnosis of distal sensory polyneuropathy. *J Neurosci Rural Pract* 2019;10(2):273-7.
10. Ghaffarinejad F, Taghizadeh S, Mohammadi F. Effect of static stretching of muscles surrounding the knee on knee joint position sense. *Br J Sports Med* 2007;41(10):684-7.
11. Lim JU, Lee JH, Kim JS, Hwang YI, Kim T, Yong S, Yoo KH, Jung KS, Kim YK, Rhee CK. Comparison of World Health Organization and Asia-Pacific Body Mass Index Classifications in Copd Patient. *Int J Chron Obstruct Pulmon Dis* 2017;12:2465-75.
12. Pisano S, Muratori P, Senese VP, Gorga C, Siciliano M, Carotenuto M, Iuliano R, Bravaccio C, Signoriello S, Gritti A, Pascotto A, Catone G. Phantom Phone Signals in youths: Prevalence, correlates and relation to psychopathology. *PLoS One* 20194;14(1):e0210095.
13. Leo KC, Soderberg GL. Relationship between perception of joint position sense and limb synergies in patients with hemiplegia. *Phys Ther* 1981;61(10):1433-7.