

of the 20th JAPAN Conference on Human Response to Vibration (JCHRV2012) pp. 92-95 (2012)

F：前田節雄、宮下和久：手腕振動測定装置の国内外の動向. 第52回近畿産業衛生学会(和歌山県立医科大学保健看護学部) 39頁(2102)

G：吉岡淳、前田節雄、宮下和久：電子メールを利用した日振動ばく露量A(8)の計算システム. 第52回近畿産業衛生学会(和歌山県立医科大学保健看護学部) 40頁(2012)

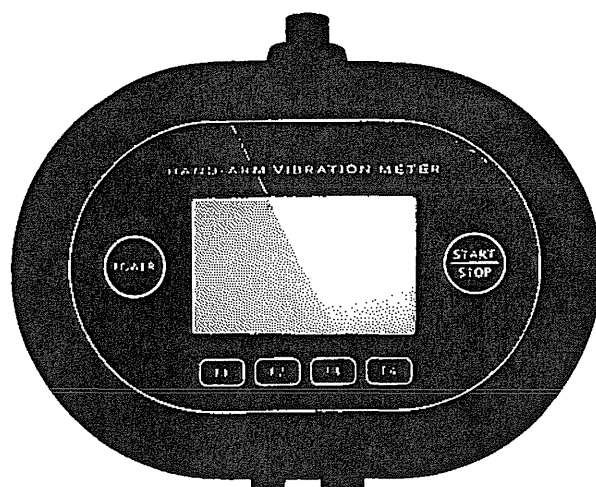
H：福元仁、前田節雄、竹村重輝、吉益光一、宮下和久：手腕振動障害を訴える手指ごとに検証した検査データの特徴について. 第52回近畿産業衛生学会(和歌山県立医科大学保健看護学部) 41頁(2012)

I：前田節雄：振動工具管理責任者向け機器の開発状況. 安全と健康 2013年3月号(印刷中)(2013)]

H. 知的財産権の出願・登録状況  
(予定を含む)

特になし。

## 手腕振動計測装置の使用性に関するアンケート



1：手腕振動計測装置の使用説明はわかりやすかったですか？

はい いいえ どちらでもない

2：手腕振動計測装置は使いやすかったですか？

はい いいえ どちらでもない

3：今回使用された手腕振動計測装置に関する意見（こうあればいいとか等）をお書き下さい。

ご協力ありがとうございました。

図1 手腕振動計測装置の使用性に関するアンケート

(a) 取扱説明風景



(b) 今回開発機器の説明風景



図2 現場での調査風景(1)

(c) 今回開発機器の計測風景



(d) 今回開発機器の計測風景

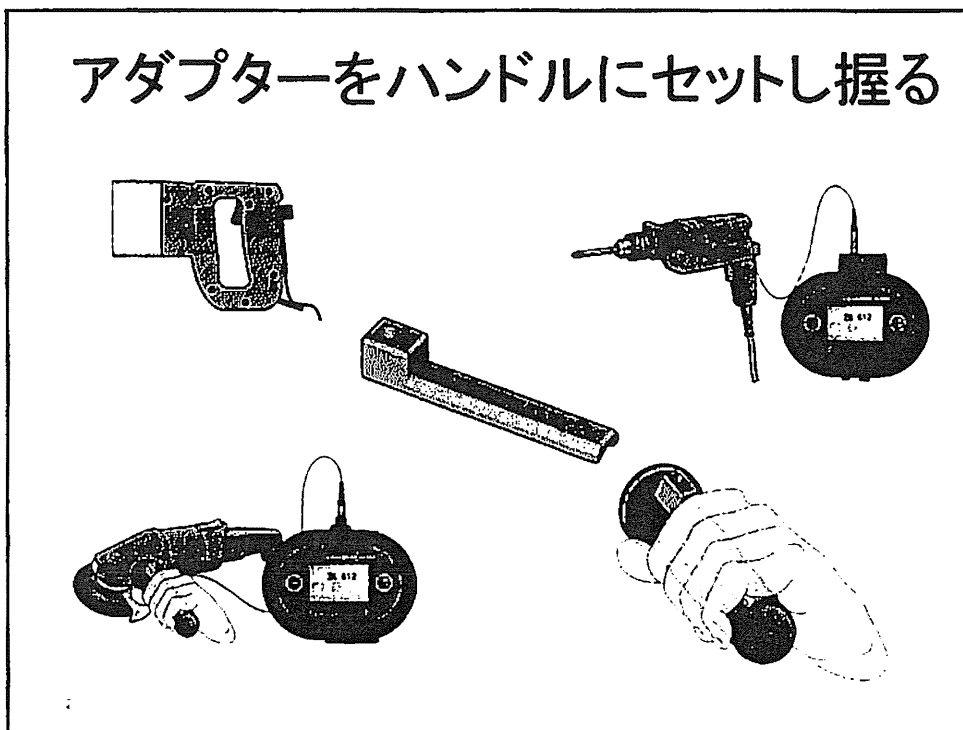
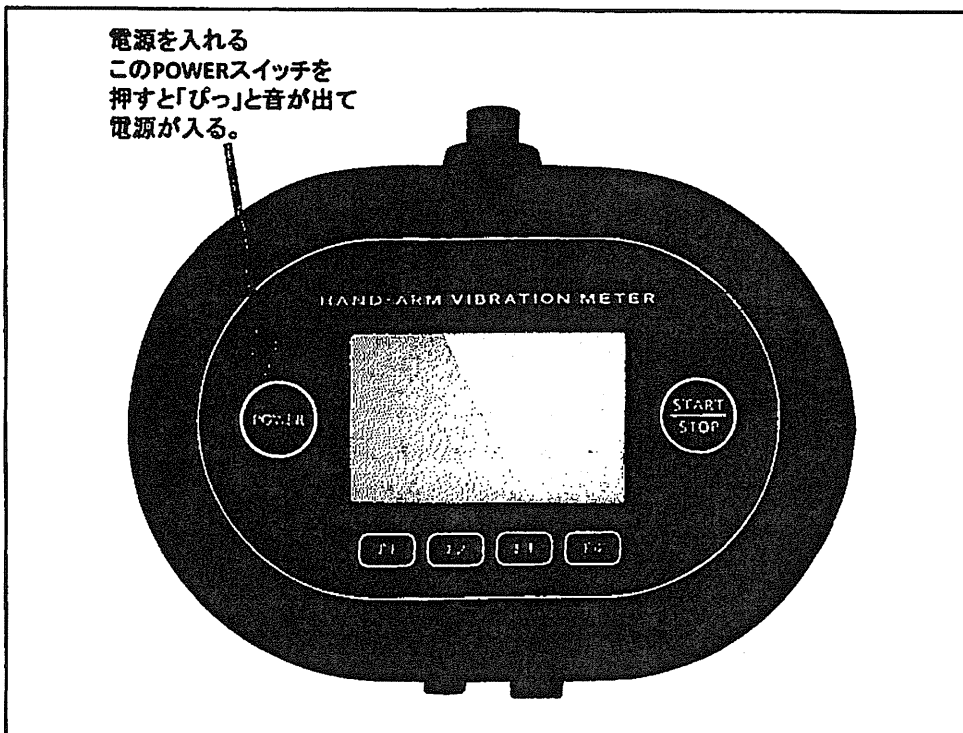


図2 現場での調査風景 (2)

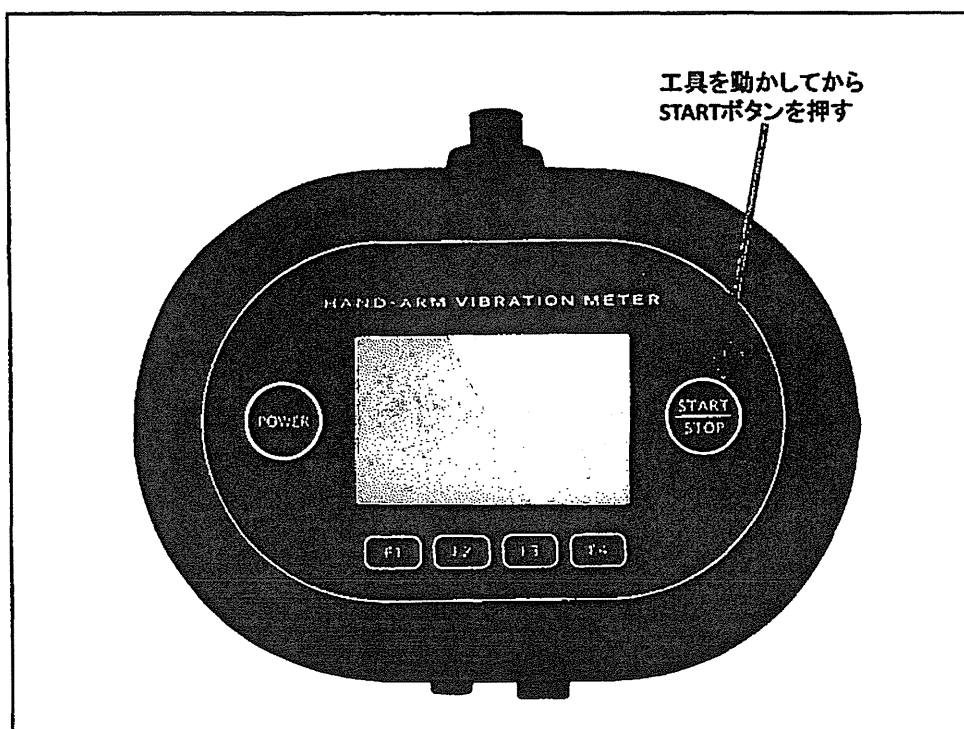
表1 使用性のアンケート結果（被験者数：12人）

設問	はい	いいえ	どちらでもない
1：手腕振動計測装置の使用説明はわかりやすかったですか？	12	0	0
2：手腕振動計測装置は使いやすかったですか？	12	0	0

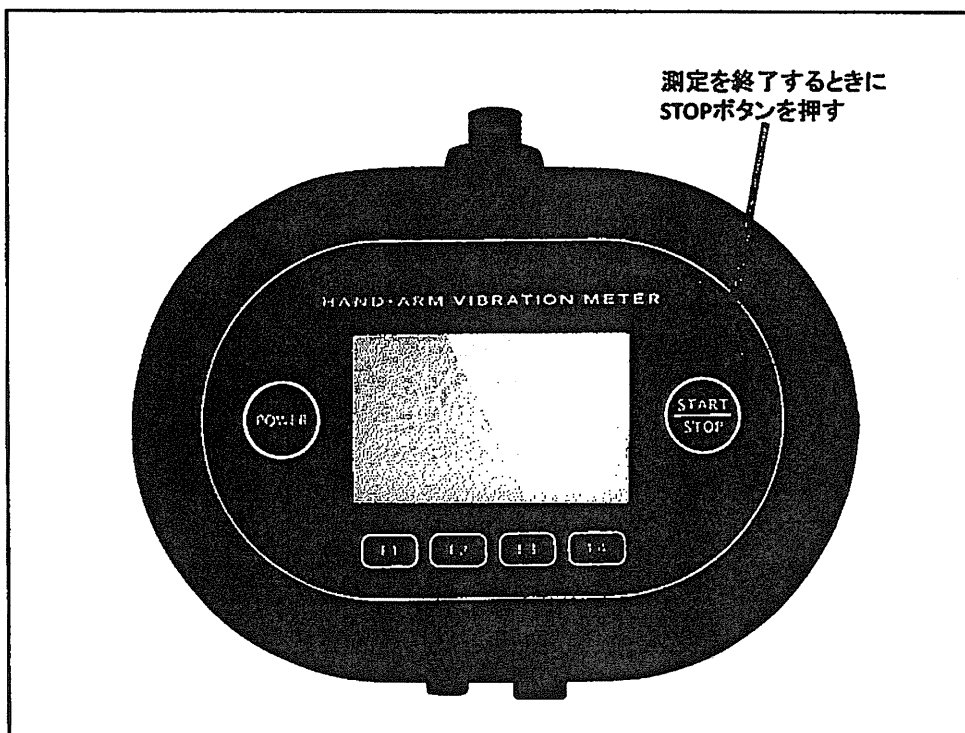
添付資料1：今回の開発機器の取扱説明資料



## 工具を普段のように動かす







### Ⅲ. 研究成果の刊行に関する一覧表

研究成果の刊行に関する一覧表

書籍

著者氏名	論文タイトル名	書籍全体の 編集者名	書 籍 名	出版社名	出版地	出版年	ページ
なし							

雑誌

発表者氏名	論文タイトル名	発表誌名	巻号	ページ	出版年
Jin Fukumoto, Setsuo Maeda, Shigeki Takemura, Kouichi Yoshimasu Kazuhisa Miyashita Nobuyuki Miyai, Ting Anselm Su, Ryuichi Nakajima, Makoto Tateno, Kyoji Yoshikawa, Yoshiro Nasu	Comparison of hand-arm vibration syndrome (HAVS) among foresters between tropical and temperate climate	internoise2012	Proceedings (CD-ROM)	pp. 1-6	2012年8月
Takayuki Mori, Setsuo Maeda, Masatomo Komai	Results of vibration measurement of Wire Brushes mounted on hand held power tools	20th JAPAN Conference on Human Response to Vibration (JCHRV2012)	Proceedings	pp. 23-29	2012年9月

Tadayoshi Mae, Setsuo Maeda, Shigenobu Yoshida, Keisuke Fujimoto, Kazuya Shimizu, Kazuhisa Miyashita	Development of simple type hand-arm vibration measurement device For person in charge of the vibration tool management	20th JAPAN Conference on Human Response to Vibration (JCHRV2012)	Proceedings	pp. 30-37	2012年9月
Atushi Yoshioka, Setsuo Maeda, Kazuhisa Miyashita	Calculation system for A(8) using email system	20th JAPAN Conference on Human Response to Vibration (JCHRV2012)	Proceedings	pp. 38-46	2012年9月
Jin Fukumoto, Setsuo Maeda, Shigeki Takemura, Kouichi Yoshimasu, Kazuhisa Miyashita Ting Anselm Su, Ryuichi Nakajima	Vibratory tools total operation time (TOT) and hand arm vibration syndrome ( HAVS ) in Japanese Wakayama forestry workers	20th JAPAN Conference on Human Response to Vibration (JCHRV2012)	Proceedings	pp. 92-95	2012年9月
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吉岡淳、前田節雄、 宮下和久	電子メールを利用した日 振動ばく露量A(8)の計 算システム	第 52 回近畿産 業衛生学会 (和歌山県立医 科大学保健看護 学部)	抄録集	40 頁	2012年11月
福元仁、前田節雄、 竹村重輝、吉益光一 宮下和久	手腕振動障害を訴える手 指ごとに検証した検査デ ータの特徴について	第 52 回近畿産 業衛生学会 (和歌山県立医 科大学保健看護 学部)	抄録集	41 頁	2012年11月
前田節雄	振動工具管理責任者向け 機器の開発状況	中央労働災害 防止協会	安全と健康 2013年3月号		2012年3月 (発行予定)

## IV. 研究成果の刊行物・別刷

- 1 : Jin Fukumoto, Setsuo Maeda, Shigeki Takemura, Kouichi Yoshimasu, Kazuhisa Miyashita, Nobuyuki Miyai, Ting Anselm Su, Ryuichi Nakajima, Makoto Tateno, Kyoji Yoshikawa, Yoshiro Nasu : Comparison of Hand-arm vibration syndrome (HAVS) among foresters between tropical and temperate climate. Proceedings of internoise2012 (CD-ROM) (2012)
- 2 : Takayuki Mori, Setsuo Maeda, Masatomo Komai : Results of vibration measurement of Wire Brushes mounted on hand held power tools. Proceedings of the 20th JAPAN Conference on Human Response to Vibration (JCHRV2012), pp.23-29 (2012)
- 3 : Tadayoshi Mae, Setsuo Maeda, Shigenobu Yoshida, Keisuke Fujimoto, Kazuya Shimizu, Kazuhisa Miyashita : Development of simple type hand-arm vibration measurement device For person in charge of the vibration tool management. Proceedings of the 20th JAPAN Conference on Human Response to Vibration (JCHRV2012), pp.30-37 (2012)
- 4 : Atushi Yoshioka, Setsuo Maeda, Kazuhisa Miyashita : Calculation system for A(8) using email system. Proceedings of the 20th JAPAN Conference on Human Response to Vibration (JCHRV2012), pp.38-46 (2012)
- 5 : Jin Fukumoto, Setsuo Maeda, Shigeki Takemura, Kouichi Yoshimasu, Kazuhisa Miyashita, Ting Anselm Su, Ryuichi Nakajima : Vibratory tools total operation time (TOT) and hand arm vibration syndrome (HAVS) in Japanese Wakayama forestry workers. Proceedings of the 20th JAPAN Conference on Human Response to Vibration (JCHRV2012) pp.92-95 (2012)
- 6 : 前田節雄、宮下和久 : 手腕振動測定装置の国内外の動向. 第 52 回近畿産業衛生学会 (和歌山県立医科大学保健看護学部) 39 頁 (2102)
- 7 : 吉岡淳、前田節雄、宮下和久 : 電子メールを利用した日振動ばく露量 A (8) の計算システム. 第 52 回近畿産業衛生学会 (和歌山県立医科大学保健看護学部) 40 頁 (2012)
- 8 : 福元仁、前田節雄、竹村重輝、吉益光一、宮下和久 : 手腕振動障害を訴える手指ごとに検証した検査データの特徴について. 第 52 回近畿産業衛生学会 (和歌山県立医科大学保健看護学部) 41 頁 (2012)
- 9 : 前田節雄 : 振動工具管理責任者向け機器の開発状況. 安全と健康 2013 年 3 月号(印刷中) (2013)



## **Comparison of Hand-arm vibration syndrome (HAVS) among foresters between tropical and temperate climate**

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Coldness is one of the important factors to involve in Hand-arm vibration (HAVS), however, reports of HAVS in the hot tropical environment are scarce and remain uncertain. The present study aimed to investigate clinical characteristics of HAVS in the tropical environment in comparison with HAVS in the temperate to cool environment. In 2011 we examined 354 Japanese (Average age 47.6 yrs) and 33 Malaysian (36.8 yrs) male tree fellers who have been occupationally exposed to Hand transmitted Vibration (HTV). As for HAVS based on Stockholm Classification, Malaysian subjects complained more frequently compared with Japanese ones in numbness with significance (36.4% vs. 20.3%, *P*-value 0.032) and pain with almost significance (30.3% vs. 16.9%, *P* value 0.055). In contrast, Malaysian complained less cold sensation with almost significance (12.1% vs. 27.7%, *P* value 0.052). Among subjects who complain HAVS, Malaysian had consistently significantly larger Vibration perception threshold (VPT) in numbness (13.7 vs. 6.1), pain (18.4 vs. 7.3), and cold sensation (20.5 vs. 4.5) with *P* value <0.001, respectively. To diagnose HAVS in the tropical environment, the key is likely to be numbness and pain in symptoms and ascending VPT in physical measurement data. These results also suggest that main factors of HAVS might be reported as neurological disturbance in the tropical environment and circulatory disturbance in the temperate to cool environment.

## 1 INTRODUCTION

Hand-arm vibration syndrome (HAVS) is one of the occupational diseases induced by long and constant hand-transmitted vibration (HTV) exposure, mainly observed among tree fellers, construction workers, and factory workers who use vibration tools. Coldness was regarded as one of the essential factor to involve in HAVS. In fact, reports concerning HAVS in the tropical environment are quite limited<sup>1-4</sup>, revealing HAVS in tropical environment are characterized as mainly moderate neurological and circulatory disturbance such as high vibration perception threshold (VPT)<sup>3</sup>, abnormal light touch sensation<sup>4</sup>. Severe HAVS such as Raynaud's syndrome were never reported.

In the present study, we aimed to assess the prevalence of HAVS among tree fellers in the tropical and the clinical characteristics of HAVS in the tropical environment by comparing data with those of Japanese tree fellers in the temperate to cool environment.

## 2 MATERIALS AND METHODS

### 2.1 Subjects and Climates of the Study Fields

This study was performed at both Malaysian and Japanese sites.

Malaysian study was performed on August 2011. The Malaysian subjects comprised all male 33 tree fellers who use vibratory tools, mainly chainsaws in the daily routine works. The mean age was 36.8 years old (Standard Deviation 9.4). The Malaysian study was performed in the timber logging camp located in the low highland in the north east Borneo Island, about 20-30 kilometers away from the sea coast. The local area is covered with typical tropical environment. The average temperature goes up to approximately 28.6 degrees centigrade (°C) annually and has a lot of rain fall all through the year.

The Japanese subjects comprised all male 385 tree fellers who received annual compulsory special health check of HAVS, also using vibratory tools, mainly chainsaws in the daily routine works, and mean age was 47.6 years old (SD 12.9). The study was performed at some places in Wakayama prefecture located in the south of mainland of Japan on November and December 2011. The local climate is roughly classified as temperate climate, however, virtually classified as cool inland climate because the altitude of the work site is about 700 meters above the sea level high covered with deep forests. In fact, the local annual average temperature is 14.5°C, falling down as low as 3.7°C in January.

## **2.2 Study Methods**

The Malaysian study was performed by Malaysian and Japanese joint team, and the Japanese study was performed by Japanese team only.

First, the subjects were collected in each room in which the temperature was kept between 20-24°C and stayed for about 30 minutes for the purpose that body temperature to be accustomed to the room temperatures. During which subjects were explained the study and filled papers of the concentration. The subjects also filled some self-questionnaire to investigate basic lifestyles, histories of exposure to HTV and symptoms relating HAVS.

Second, subjects underwent a series of physical measurements such as skin temperature, hand grip strength, pinch grip strength and vibrotactile perception thresholds (VPT).

Third, subjects underwent cold water provocation tests, with methods water temperature 5°C and 1 minute in Malaysia and 12°C and 5 minutes in Japan. After provocation, recovery of skin temperatures and VPTs were observed for ten minutes.

Finally, respective native doctors checked and interviewed subjects to examine HAVS based on Stockholm Classification. Both of the studies were performed in accordance with uniformed study method originally produced by Japan except for cold water provocation test.

The present study was approved by committees of ethics by both Malaysian and Japanese universities.

## **2.3 Statistical analysis**

Mann-Whitney U test was used to compare amount of operation of vibration tools of between Malaysia and Japanese subjects. In the present study, we adopted original unique term Total Operation Time (TOT) to estimate total amounts of exposure to vibration. TOT is calculated by operation hours/day times operation days/year times total engaged years.

Next, chi-square test was used to compare clinical characteristics of HAVS (numbness, pain, chill and vibration induced white finger (VWF) among the subjects.

Finally, unpaired t-test was used to compare physical measurement data among HAVS positive subjects between Malaysia and Japan for the purpose of evaluating HAVS relating physical data between tropical and temperate environments.

## **3 RESULTS**

Comparison of total amount of exposure to vibration is shown in Table1. Malaysian subjects were significantly younger and had less total operation years than Japanese subjects. In contrast, Malaysian subjects had significantly more operation hours and days resulting in having significantly more TOT than Japanese subjects.

Clinical characteristics of HAVS among subjects are shown in Table2. Malaysian subjects complained more frequently compared with Japanese ones in numbness with significance (36.4%

vs. 20.3%, *P* value 0.032) and pain with margin significance (30.3% vs. 16.9%, *P* value 0.055). In contrast, Malaysian complained less cold sensation with margin significance (12.1% vs. 27.7%, *P* value 0.052). No Malaysian subjects complained they had vibration induced white finger (VWF), nine (2.6%) Japanese subjects notified they had VWF.

Among subjects who complain HAVS, Malaysian had consistently significantly larger VPT in numbness (13.7 vs. 6.1), pain (18.4 vs. 7.3), and cold sensation (20.5 vs. 4.5) with *P* value <0.001 compared with Japanese subjects, respectively.

#### **4 DISCUSSION**

In the present study, we performed international joint study to evaluate prevalence and characteristics of HAVS in tropical environment which still remain uncertain.

Compared with Japanese subjects, Malaysian subjects were significantly younger and had less total operation hour, however, Malaysian subjects had significantly more operation hours and days. The Japanese employment contracts are strongly preserved and working hours are strictly restricted. On the other hands, half of Malaysian workers consist of local native races and the rest Indonesians coming in search of work. They do not have working time limitation, health check system. Hence, compared with Japanese subjects, Malaysian subjects evidently work double times and have twice TOT.

As for HAVS, Malaysian subjects complained dumbness and pain more frequently, and so do Japanese subjects chill. These results might indicate that neurological disturbance is dominant in tropical environment and circulatory disturbance is dominant in temperate to cool environment. The finding in tropical environment agrees with previous report<sup>4</sup>.

The difference of characteristics of HAVS positive subjects between tropical and temperate to cool environment are summarized as such; 1) No differences are observed among skin temperature, pinch strength measurement; 2) Nail suppression tests of all the tropical subjects are significantly prolonged (data not shown), however, the significance diminishes if the subjects are restricted with HAVS positive; 3) VPT is significantly larger in tropical environment; 4) Therefore, the key symptom of HAVS in tropical environment is likely to be dumbness in symptom and ascending VPT in physical measurement data.

We measured the magnitude of vibration the subjects exposed but did not take into account in analysis. The Malaysian collaborate researcher Anselm Su Ting is preparing a paper reporting the association HAVS and magnitude of vibration.

In summary, HAVS in tropical environment was examined in this study, revealing prevalence and characteristics which had remained uncertain due to scare reports. It is important to continue the study to examine HAVS in tropical environment and establish a method to protect tropical occupationally HAT exposed workers form HAVS.

#### **5 ACKNOWLEDGEMENT**

This study was supported in part by a Grant- in-Aid for the Scientific Research (C) (235907750) form Japan society of the promotion of Science.

#### **6 REFERENCES**

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2. Futatsuka M, Inaoka T, Ohtsuka R, Sakurai T, Moji K, Igarashi T. Hand-arm vibration in tropical rain forestry workers. *Cent Eur J Public Health*, 3(SUPPL), (1995)
3. Futatsuka M, Shono M, Sakakibara H, Quoc Quan P. Hand arm vibration syndrome among quarry workers in Vietnam. *J Occup Health.*, 47(2), (2005)
4. Su TA, Hoe VCW, Masilamani R, Awang Mahmud AB. Hand-arm vibration syndrome among a group of construction workers in Malaysia. [Article]. *Occup Environ Med.*,68(1), (2011)

*Table1 – Amount of operation of vibration tools of the subjects*

	Malaysia (n=33)	Japan (n=350)	P value*
Age (year)	36.8 (9.4)	47.6 (12.9)	< 0.001
Operation total years	13.2 (8.5)	15.3 (10.2)	0.88
Operation days/year	275.0 (45.1)	163.7 (58.6)	< 0.001
Operation hours/day	10.1 (0.6)	4.9 (1.6)	< 0.001
Average TOT ( $\times 10^3$ )	37.1	11.2	< 0.001

Data are means +/- SD, \*Mann-Whitney test. TOT, total operation time.

TOT is calculated age\*operation total years\*operation hours/day

*Table2 - Clinical characteristics of HAVS among the subjects*

	Malaysia (n=33)		Japan (n=350)		P value*
	YES	NO	YES	NO	
Numbness	12 (36.4%)	21 (63.6%)	71 (20.3%)	279 (79.4%)	0.032
Pain	10 (30.3%)	23 (67.9%)	59 (16.9%)	291 (83.1%)	0.055
Chill	4 (12.1%)	29 (87.9%)	97 (27.7%)	253 (72.3%)	0.052
VWF	0 (0.0%)	33 (100.0%)	9 (2.6%)	341 (73.4%)	0.351

\*Using chi-square test. VWF, vibration induced white finger.

Table3 – Major physical measurement data among HAVS positive subjects

	Skin temperature (°C)			Nail suppression test (sec)			VPT (dB)			Pinch strength measurement (Kg)		
	Malaysia	Japan	<i>P</i> value	Malaysia	Japan	<i>P</i> value	Malaysia	Japan	<i>P</i> value	Malaysia	Japan	<i>P</i> value
Dumbness	26.9	27.6	0.61	1.62	1.43	0.05	13.7	6.1	<0.01	4.4	4.1	0.53
Pain	27.2	28.3	0.45	1.73	1.50	0.16	18.4	7.3	0.02	5.4	4.3	0.29
Chill	27.8	27.6	0.91	1.68	1.43	0.23	20.5	4.5	<0.01	4.0	4.1	0.86

\*Using unpaired *t*-test. HAVS, hand arm vibration syndrome; VPT, vibrotactile perception threshold.

**Results of vibration measurement of Wire Brushes  
mounted on hand held power tools**

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**Abstract**

The purpose of this study is to clarify the vibration value of wire cup brushes mounted on handheld power tools. The measurement of the vibration value was taken by the hand vibration and evaluation method stipulated by ISO5394-2(JIS B7761-2&JIS7761-3), and the result of the measurement was evaluated by the influence assessment method stipulated by ISO, JIS and `The Vibration Guideline` issued by the Japanese Ministry of Health, Labor and Welfare on July 10<sup>th</sup>, 2009. Additionally, we measured the balance value of the wire cup brushes and investigated its relationship with the vibration value.

As a result, we found out the correlation between the vibration value and the balance value of wire cup brushes. Furthermore, the result shows that if the balance value of the wire cup brushes were controlled within 2.3g, keeping the vibration value within 5.0m/s<sup>2</sup> (the Daily Vibration Exposure Limited Time suggested by `The Vibration Guideline`) could be possible.

## 1. Introduction

The purpose of this study is to clarify the relationship between the vibration value of wire cup brushes mounted on handheld power tools and the balance value of wire cup brushes.

According to Professor Maeda of Kinki University (Safety and Healthy Vol12 No2 2012 , issued by Japan Industrial Safety and Health Association), it is possible to prevent Hand-Arm Vibration Syndrome by choosing tools with the least vibration as possible.

It is considered that the exposure to vibration through the use of handheld power tools at one's workplace should be the cause of Hand-Arm Vibration Syndrome. Therefore, it becomes necessary to reveal whether the actual vibration exposure of the handheld tools is dangerous enough to be the cause of Hand-Arm Vibration Syndrome.

However, there is not so many data available regarding to the vibration values when a wire cup brush is attached to the grinder in use, and there are no international rules and regulation for measuring the vibration values of various types of handheld vibrating tools with wire cup brushes attached.

Therefore, in order to reveal the vibration risk hidden in the worksite, we investigated the actual vibration situation of wire cup brushes mounted on handheld power tools, and made this investigation by the method stipulated by ISO5349-1 and ISO5394-2 (JIS B 7761-2, JIS B 7761-3). And we evaluated the result of which according to ISO, JIS, and vibration guidelines issued by Japanese Ministry of Health, Labor and Welfare on July, 10 2009.

## 2. Cup brush

The wire cup brush is used on handheld tools such as grinders, to clean & polish the surface of the workpiece by spinning at high speed. (Fig2)

There are two types, one for electric tools and one for pneumatic, which have an outer diameter of 30 to 150 mm.

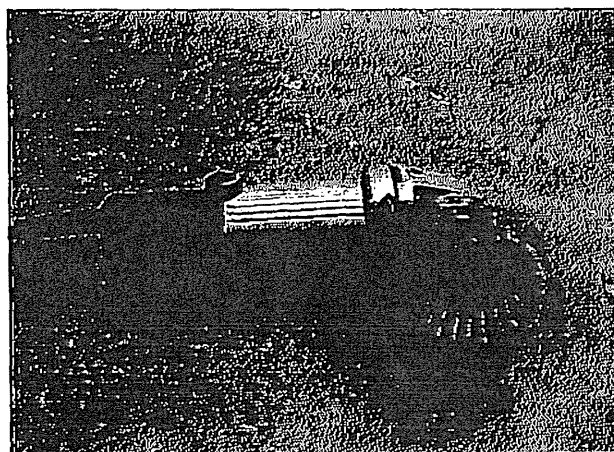


Fig.1 Cup brush is attached to a handheld power tool (grinder)



Fig.2 state of work