# SIMULTANEOUS CHANGE OF ANGULAR VELOCITY AND RESISTANCE RIGHT AFTER NEEDLE ACUPUNCTURE IN UPPER EXTREMITY FOR PATIENTS WITH STROKE

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**Abstract**- Using needle acupuncture to improve the spasticity status in patients with stroke is currently undoubtable. Many studies have presented about the effectiveness on improvement of spasticity change in patients with stroke. However, the dynamic condition during test was less discussed. Fifteen subjects were enrolled into this pilot study. We used the measurement device which contained pressure sensor and accelerometer to detect the dynamic changes in angle, angular velocity, and resistance during spasticity test. The results in modified Ashworth scale and power throughout the spasticity were decreasing. We also can distinguish the results from before and right after needle acupuncture in dynamic changes curve. MAS is the subjective measure in spasticity test, but power is the objective measurement. Power means how much effort patients performed. We can obtain power decreasing right after needle acupuncture intervention. The results consisted with clinical finding.

**Index Terms**- Needle Acupuncture, Spasticity, Stroke, modified Ashworth scale (MAS), power

## I. INTRODUCTION

Acupuncture is the common treatment intervention in traditional Chinese medicine. Recently, many researches presented that acupuncture is useful in reducing spasticity in patients with stroke[1]. Acupuncture treatment is not only effective on decreasing the modified Ashworth scale (MAS) in the clinically[2-4], but also increasing the regional cerebral blood flow (rCBF) in single-photon emission computed tomography (SPECT) study[5]. However, dynamic parameters during spasticity test right after needle acupuncture were less discussed. The goals of this study is to obtain and compare the dynamic parameters about force, angle, and angular velocity before and right after needle acupuncture in patients with stroke.

## II. MATERIALS AND METHODS

### A. Subjects

This study is approved by the IRB of Kaohsiung Veterans General Hospital and is conducted in accordance with the Helsinki Declaration. All the written informed consents from patients were obtained. There are fifteen patients with stroke recruited in this study, and not limited to once examination. The details were listed in Table 1.

### B. Measurement Device

The wearable measurement device was developed in this study. The dynamic parameters included force, angle, and angular velocity. The sampling rate was set as 15 Hz. All test was performed within one second. The modified Ashworth scale (MAS) was also recorded before and right after needle acupuncture. The device was presented in fig 1. The power throughout the spasticity test was defined as:

$$Power = \int torque \cdot w \, dt$$

Among the equation, torque was defined as force product forearm length (28.99cm), w was the angular velocity during the spasticity test.



**Fig. 1 Wearable measurement device.**

### C. Acupuncture intervention

All procedure was performed by traditional Chinese physician in Traditional Medical Department of Kaohsiung Veterans General Hospital. The points of needle acupuncture included Neiguan (PC6), Shaohai (HT3), Shounizhu (Ex-UE), and Zeqian (Ex-Ue). The duration of needle acupuncture was about 15 minutes.

## III. RESULTS

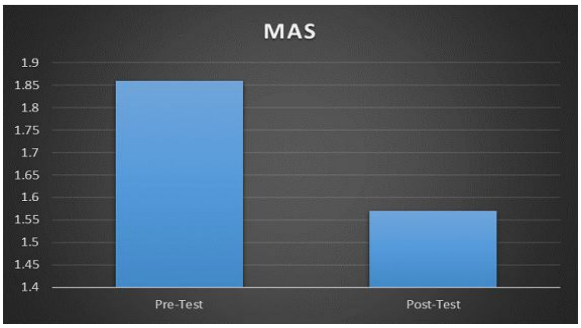
There were fifteen subjects enrolled into this study, and total test (each subjects not limited to once test) was 23 times. The modified Ashworth scale (MAS) before and right after needle acupuncture was 1.87±0.92 and 1.57±0.99, respectively, but there was no statistical significant difference (p=0.068). The power throughout the spasticity test before and right after needle acupuncture were 21.98 ± 9.49 and 19.73 ± 8.52, respectively, and there was no statistical significant difference (0.089). The dynamic parameters included force, angle, and angular velocity were plotted in Fig. 2. The maximal values of these parameters during the spasticity test included maximal force, maximal angle, and maximal angular velocity was also recorded. The results of these parameters were presented in Table 2.

**Table 1. Subjects General Characteristics**

| Subjects | Characteristics |
|---|---|
| Number | 15 |
| Age (y/o) | 61.6 ± 11.71 |
| Gender (M:F) | 8:7 |
| Post onset (m) | 22.4 ±29.43 |

Table 2. Comparison the parameters of spasticity test before and right after needle acupuncture

| | before | after | p |
|---|---|---|---|
| MAS | 1.86 ± 0.92 | 1.57 ±0.99 | 0.068 |
| Power | 21.98 ± 9.49 | 19.73 ± 8.52 | 0.089 |
| Max. Angle | 165.39 ± 20.02 | 161.61 ± 19.49 | 0.543 |
| Max. Angular Velocity | 241.74 ± 23.49 | 240.06 ± 25.98 | 0.213 |
| Max. Force | 1.07 ± 0.53 | 1.00 ± 0.40 | 0.454 |



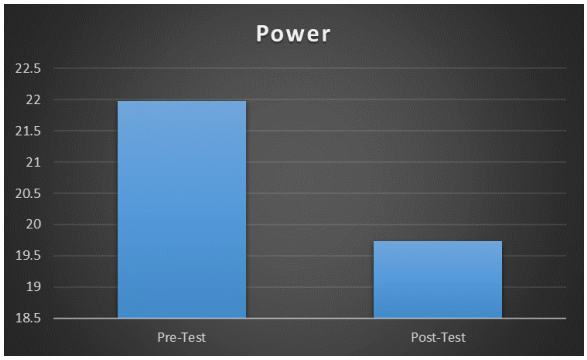




**Fig.2 MAS and power before and after needle acupuncture**

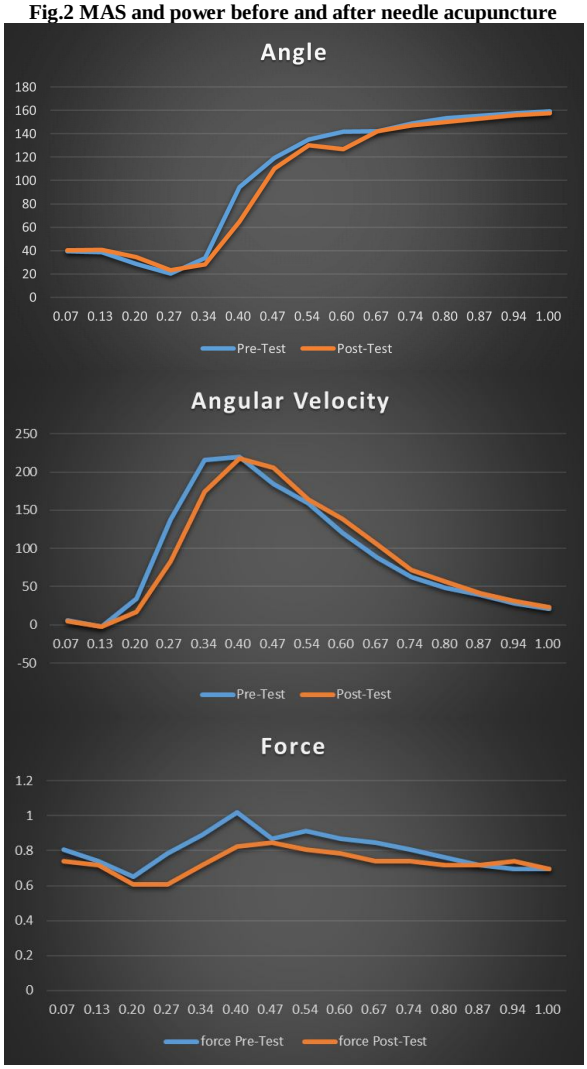



**Fig.3 Dynamic changes during spasticity test**

## IV. DISCUSSION

Although there was no statistical significant difference in MAS or power between before and right after needle acupuncture in patients with stroke, we still can obtain the tendency that MAS and power decreased right after acupuncture intervention.

Dynamic changes in force, angle, and angular velocity presented in Fig.3. We can easy distinguish the results of before and right after needle acupuncture from the dynamic curve, but there was no statistical significant difference in maximal force, maximal angle, and

maximal angular velocity. According the results curve, it maybe that maximal values of these parameters were no the major characteristics between before and right after needle acupuncture.

MAS is the subjective measure in spasticity test, but power is the objective measurement. Power means how much effort patients performed. We can obtain power decreasing right after needle acupuncture intervention. The results consisted with clinical finding.

Less subjects were the major limitation in this study. We will persist perform this study, and expect that we can obtain statistical significant difference between before and right after needle acupuncture.

## CONCLUSION

Using needle acupuncture to improve the spasticity status in patients with stroke is currently undoubtable. Traditionally, modified Ashworth scale (MAS) is the subjective measurement to assess the difference the severity of spasticity. Objective measurement during spasticity test was less discussed. In our study, not only MAS and power decreased after needle acupuncture intervention, but also dynamic changes curve presented the difference between before and right after needle acupuncture intervention. Although there was no statistical significant difference in MAS, power, maximal force, maximal angle, and maximal angular velocity, we still can get the tendency to distinguish the results from before and right after needle acupuncture. MAS is the subjective measure in spasticity test, but power is the objective measurement. Power means how much effort patients performed. We can obtain power decreasing right after needle acupuncture intervention. The results consisted with clinical finding.

## REFERENCES

[1] S. M. Lim, J. Yoo, E. Lee, H. J. Kim, S. Shin, G. Han, et al., "Acupuncture for Spasticity after Stroke: A Systematic Review and Meta-Analysis of Randomized Controlled Trials," Evidence-Based Complementary and Alternative Medicine, vol. 2015, p. 12, 2015.

[2] M. Fink, J. D. Rollnik, M. Bijak, C. Borstädt, J. Däuper, V. Guergueltcheva, et al., "Needle acupuncture in chronic poststroke leg spasticity," Archives of Physical Medicine and Rehabilitation, vol. 85, pp. 667-672, 2004.

[3] J.-G. Zhao, C.-H. Cao, C.-Z. Liu, B.-J. Han, J. Zhang, Z.-G. Li, et al., "Effect of acupuncture treatment on spastic states of stroke patients," Journal of the Neurological Sciences, vol. 276, pp. 143-147, 2009.

[4] P. Singh, A. M. Joshua, S. Ganeshan, and S. Suresh, "Intra-rater reliability of the modified Tardieu scale to quantify spasticity in elbow flexors and ankle plantar flexors in adult stroke subjects," Annals of Indian Academy of Neurology, vol. 14, pp. 23-26, 2011.

[5] J. D. Lee, J. S. Chon, H. K. Jeong, H. J. Kim, M. Yun, D. Y. Kim, et al., "The cerebrovascular response to traditional acupuncture after stroke," Neuroradiology, vol. 45, pp. 780-784, 2003.

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