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**Special Topic Study**

# Clinical observation on acupuncture plus occupation therapy for fine motor functions in children with spastic cerebral palsy

## 针刺配合作业治疗改善痉挛型脑瘫患儿精细功能的观察

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**Abstract**

**Objective:** To observe the clinical effect of acupuncture plus occupation therapy for fine motor functions in children with spastic cerebral palsy.

**Methods:** A total of 80 cerebral palsy kids with fine motor dysfunction were allocated into two groups by envelop, 40 cases in each group. Cases in the control group were treated with occupation therapy. Based on the therapy given to the control group, cases in the treatment group were supplemented with acupuncture at the points of the three yang meridians of hand. The treatment was done every other day and 10 times for a course. There was a 15-day interval between two courses, and 3 courses in total. The therapeutic efficacies were evaluated using Peabody developmental motor scale 2 (PDMS-2) and modified Ashworth scale (MAS) before and after treatment.

**Results:** After treatment, the standard score for grasping (Grs), standard score for visual-motor integration (Vis), fine motor quotient (FMQ) and modified Ashworth scale (MAS) were significantly improved in both groups ($P<0.05$). The improvement in the treatment group was more obvious than that in the control group ($P<0.01$).

**Conclusion:** Acupuncture plus occupation therapy can achieve better effect than occupation therapy alone in improving fine motor functions of upper limbs in cerebral palsy kids.

**Keywords:** Acupuncture Therapy; Occupational Therapy; Cerebral Palsy; Upper Extremity; Psychomotor Performance; Child

**【摘要】目的：**观察针刺配合作业治疗改善脑性瘫痪患儿上肢精细功能的临床疗效。**方法：**将精细功能障碍的脑性瘫痪患儿 80 例采用信封法随机分为治疗组和对照组，每组 40 例。治疗组在作业治疗的基础上配合针刺手三阳经穴位，对照组仅采用作业治疗，隔日治疗 1 次，10 次为 1 个疗程，每个疗程后休息 15 d，连续观察 3 个疗程。治疗前后使用 Peabody 运动发育量表和改良 Ashworth 法进行评定。**结果：**治疗后两组抓握标准分、视觉-运动统合标准分、精细动作发育商、改良 Ashworth 法评分较本组治疗前均有改善(均 $P<0.05$)，且治疗组改善明显优于对照组(均 $P<0.01$)。**结论：**针刺配合作业治疗能有效改善脑性瘫痪患儿的上肢精细功能，疗效优于单纯作业治疗。

**【关键词】**针刺疗法；作业治疗；脑性瘫痪；上肢；精神运动性行为；儿童

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Cerebral palsy (CP) refers to a group of permanent disorders of the development of movement and posture that are non-progressive disturbances that occur in the developing fetal or infant brain. The spastic CP which occurs in 60%-70% of all cases is the most common type. Kids with spastic CP usually suffer from upper limb movement disorders which cause many inconveniences in their daily life[1]. We've treated 40 kids with acupuncture plus occupation therapy and observed its effect on the upper limb movement. The results are now summarized as follows.

## 1 Clinical Data

### 1.1 Diagnostic criteria[2]

1.1.1 Definition of CP

This was based on the definition of CP stipulated in National Infantile CP Conference in 2006[3] and the Chinese version was stipulated in April, 2014: CP refers to a group of permanent central movement and posture disorders that are caused by non-progressive

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disturbances which occurred in the developing fetal or infant brain. Such motor impairment is usually accompanied by sensory, perceptual, cognitive, communication and behavior disturbances, or epilepsy and secondary skeletal musculature problems[4].

1.1.2 Diagnostic criteria

Essential criteria: (1) Permanent central motor impairment, major motor impairment such as difficulties to raise head, turn over, sit, crawl, stand and walk, fine motor impairment or other obvious development defect; (2) movement and posture development disorder should be observed in both dynamic and static state, as well as in prone, supine, sitting and standing position. Pay attention to the posture happened in different age groups when judging disorder and difference of motor pattern in disorder cases; (3) reflection development disorder includes delayed or disappeared primitive reflex and upright reflex (such as protective stretch reflex). Delayed or disappeared balance reflex which may be accompanied by positive pathological reflex; (4) abnormal muscle tone and strength: muscle strength decrease in most cases, but muscle hypertonia in spastic CP. In dyskinetic CP, muscle tone increases in movement or excited state and decreases in quiet state.

Reference criteria: (1) Etiological basis of CP; (2) cranial imaging evidence.

Diagnostic criteria: Met the above 4 essential criteria, while the reference criteria can help to determine the cause.

**1.2 Inclusion criteria**

Those who met the diagnostic criteria for CP coupled with hypermyotonia and dyskinesia in the upper limbs; aged between 1-6 years; the guardians signed the informed consent to the treatment.

**1.3 Exclusion criteria**

Those who strongly resisted the treatment, thus failed to complete the course; unable to judge the therapeutic effect or lack of essential information; interrupted or failed to follow the course; those who had epilepsia, dysbolism, chromosomal disease or acute malnutrition.

**1.4 Statistical method**

The data processing was done using the SPSS 19.0 version software. The enumeration data comparison was conducted by the Chi-square test. The mean ± standard deviation ( $\bar{x}$ ±*s*) was used to describe measurement data of normal distribution, whereas median ± quartile (M±Q) was used to describe measurement data of non-normal distribution. The independent sample *t*-test was used for between-group comparison, whereas paired sample *t*-test was used for inter-group comparison. The inspection level $\alpha$=0.05. A *P* value of less than 0.05 indicated a statistical significance.

**1.5 General data**

A total of 80 hospitalized CP infants between May 2014 and April 2015 were randomly allocated into a treatment group ($n$=40) and a control group ($n$=40) with envelop method. Twenty-three cases aged 1-3 years old and 17 cases aged 3-6 years old were treated in the treatment group. Twenty-four cases aged 1-3 years old and 16 cases aged 3-6 years old were treated in the control group. There were no between-group statistical differences in age and gender, indicating that the two groups were comparable (Table 1).

**Table 1. Comparison of the general data between the two groups**

| Group | *n* | Gender (case) | | Average age ( $\bar{x}$ ±*s*, year) |
|---|---|---|---|---|
| | | Male | Female | |
| Treatment | 40 | 22 | 18 | 2.61±1.52 |
| Control | 40 | 23 | 17 | 2.72±1.54 |
| Statistical value | | 0.0508[1)] | | 0.3215[2)] |
| *P*-value | | 0.8217 | | 0.7487 |

Note: 1) $x^2$ value; 2) *t*-value

## 2 Treatment Methods

**2.1 Treatment group**

2.1.1 Occupation therapy

Occupation therapy included facilitation technique, visual tracking, grabbing, relaxing and stretching of hand, cognition, hand-eye coordination, hand midline control, solo and coordinate movement of fingers, hand movements, etc. The treatment was done every other day and last 20-30 min every time. The guardians were instructed to do the rehabilitation training at home. 1 course of treatment cost 3 months.

2.1.2 Acupuncture therapy

Points: Jianyu (LI 15), Jianzhen (SI 9), Quchi (LI 11), Shousanli (LI 10), Waiguan (TE 5), Baxie (EX-UE 9) on the affected side.

After routine sterilization, disposable filiform needles of 0.30 mm in diameter and 25 mm or 40 mm in length were inserted into points. Penetration needling was applied to Jianyu (LI 15) in the direction of Jiquan (HT 1) and Quchi (LI 11) in the direction of Xiaohai (SI 8) for 1.0-2.0 cun; Jianzhen (SI 9) was punctured perpendicularly for 1.5-2.0 cun; Waiguan (TE 5) was punctured obliquely upward for 1.0-1.5 cun; Baxie (EX-UE 9) were punctured horizontally for 0.5-1.0 cun. Small range lifting and thrusting was manipulated at Jianyu (LI 15), Jianzhen (SI 9), Quchi (LI 11), Shousanli (LI 10), Waiguan (TE 5). All needles were retained for 20 min.

Course: The treatment was done once every other day, 10 times made up a treatment course. The cases

were treated for a total of 3 courses and there was a 15-day interval between two courses.

**2.2 Control group**

Kids in the control group only received the same rehabilitation training as those in the treatment group.

## 3 Therapeutic Efficacy Observation

**3.1 Observation items**

The Peabody developmental motor scale 2 (PDMS-2) which was stipulated by Peking University Medical Press[5] was used for evaluation. This scale targets at 2 function units including grasping (26 items) and visual-motor integration (72 items) with the same test items for 0-6 year old kids. Each item in different motor function units is scored 0, 1, 2 separately. Kids who reach the master standard are marked 2, close to but not reach the master standard are marked 1, failed or cannot attempt to finish the item, or the attemption failed to manifest the certain function are marked 0. The original score is the aggregated item score. The evaluation results are expressed by development quotient in which the fine motor quotient (FMQ) can represent fine motor development status. In FMQ, score 121-131 means excellent, 111-120 means above the average, 90-110 means average, 80-89 means below the average and 35-69 means poor. The standard score for grasping (Grs) and standard score for visual-motor integration (Vis) are calculated before and after treatment. The FMQ is based on the 2 function unit score mentioned above.

The modified Ashworth scale (MAS) was used to evaluate the muscle tone. 5 levels are set to describe the ascending muscle tone degree: 0, Ⅰ, Ⅰ$^+$, Ⅱ, Ⅲ and Ⅳ, in which 0 is normal and Ⅳ is the supreme. They are recorded as 0, 1, 2, 3, 4 and 5 for convenience.

**3.2 Results**

Before the treatment, there was no between-group statistical significance in comparing Grs, Vis, FMQ and MAS (all $P>0.05$). After the treatment, Grs, Vis, FMQ and MAS were significantly improved in both groups (both $P<0.05$), and the improvements were more significant in the treatment group than that in the control group ($P<0.05$), (Table2-Table 5).

**Table 2. Between-group comparison of Grs before and after treatment ( $\bar{x}$ ±s, score)**

| Group | *n* | Before treatment | After treatment | *t*-value | *P*-value |
|---|---|---|---|---|---|
| Treatment | 40 | 5.25±2.35 | 7.20±1.80 | 4.1653 | 0.0001 |
| Control | 40 | 5.38±2.16 | 6.30±1.80 | 2.0825 | 0.0406 |
| *t*-value | | 0.2478 | 2.2357 | | |
| *P*-value | | 0.8049 | 0.0282 | | |

**Table 3. Between-group comparison of Vis before and after treatment ( $\bar{x}$ ±s, score)**

| Group | *n* | Before treatment | After treatment | *t*-value | *P*-value |
|---|---|---|---|---|---|
| Treatment | 40 | 5.70±2.74 | 7.85±2.25 | 3.8382 | 0.0003 |
| Control | 40 | 5.88±2.08 | 6.85±1.94 | 2.1681 | 0.0332 |
| *t*-value | | 0.3220 | 2.1289 | | |
| *P*-value | | 0.7483 | 0.0364 | | |

**Table 4. Between-group comparison of FMQ before and after treatment ( $\bar{x}$ ±s, score)**

| Group | *n* | Before treatment | After treatment | *t*-value | *P*-value |
|---|---|---|---|---|---|
| Treatment | 40 | 71.05±9.05 | 81.10±8.47 | 5.1281 | 0.0000 |
| Control | 40 | 70.88±11.66 | 76.38±12.00 | 2.0792 | 0.0409 |
| *t*-value | | 0.0750 | 2.0351 | | |
| *P*-value | | 0.9404 | 0.0452 | | |

**Table 5. Between-group comparison of MAS before and after treatment ( $\bar{x}$ ±s, score)**

| Group | *n* | Before treatment | After treatment | *t*-value | *P*-value |
|---|---|---|---|---|---|
| Treatment | 40 | 2.20±0.94 | 1.28±0.88 | 4.5535 | 0.0000 |
| Control | 40 | 2.10±0.93 | 1.68±0.80 | 2.1970 | 0.0310 |
| *t*-value | | 0.4790 | 2.1352 | | |
| *P*-value | | 0.6333 | 0.0359 | | |

## 4 Discussion

CP refers to a group of permanent central movement and posture disorders that are caused by non-progressive disturbances which occurred in the developing fetal or infant brain. Hand motor dysfunction is more common and severe in spastic CP. Fine motor function is established on the basic posture and movement through growth. Vision is also affected by the development of these elements which in turn will promote the development of fine motor function[6]. Meanwhile, development of fine motor function in the early stage of life can promote the formation of recognition capability[7]. The research has shown that deprivation of front jaw sensory and fine movement in the early stage of life will affect rat's synaptic plasticity in Schaffer-CA1 path which might be the electro-physiological mechanism for rat's spatial learning and memory impairment and also provide a proof for the connection between sensory, fine motor development and recognition capability[8]. Former treatment for spastic CP kids is more focused on the recovery of gross motor functions such as walking. Research in recent years has proven the correlation between CP kids' hand motor function capability and their self-care ability of daily life. Therefore, strengthening of hand motor

 

function can help promote intelligence and motion ability as well as social participation of CP kids, and thus improve their quality of life (QOL)[9].

After 3 courses of treatment, in the treatment group, 30 kids' Grs score, 31 kids' Vis score and 36 kids' FMQ score increased and 38 kids' MAS score decreased; in the control group, 18 kids' Grs score, 34 kids' Vis score, 34 kids' FMQ score increased and 10 kids' MAS score decreased. Statistical analysis showed the differences before and after treatment were statistically significant in both groups ($P<0.05$). Though the FMQ difference before and after treatment showed statistically significance, CP kids' FMQ score was far below that in healthy kids. So, after treatment, spastic CP kids' fine motor functions were improved but far behind the level of normal kids. Moreover, in the long course of rehabilitation, cooperation of the guardians also plays a very important role[10]. Acupuncture is one of the most important approaches to treat CP. According to traditional Chinese medicine (TCM) theory of taking Yangming Meridian for treating flaccidity, points from Yangming Meridians are more commonly used in treating CP. Liu WH, *et al*[11] used Sanjian (LI 3), Hegu (LI 4), Pianli (LI 6), Yangxi (LI 5), Houxi (SI 3), Yangchi (TE 4) from the three yang meridians of hand to balance yin and yang to treat finger spasm after stoke, and thus promote the recovery of fine motor functions of hand. One research showed that when acupuncture was applied to the unaffected side, the H/M max ratio on EMG decreased more significantly than that caused by acupuncture at the affected side, which means points on the unaffected side is more useful for relieving spasm[12]. Other research showed that acupuncture at Shousanli (LI 10), Waiguan (TE 5), which are points locate on the antagonistic muscles of the spasm muscle, can promote the central compensation mechanism by peripheral nerve stimulation[13]. Meanwhile, according to bilateral regulating function of acupuncture, stimulating spasm muscle can inhibit spasm effectively[14]. The benign stimulation of acupuncture plus occupation therapy can effectively enhance neural transmission, relieve muscle tone in spasm state and enhance muscle strength, and therefore, can achieve the goal of rehabilitation. In former studies, therapeutic effect in lower age group was better than that in higher age group, indicating that nerve plasticity is better in the early stage of life. Thus, detection, treatment and intervention in the early stage is more beneficial to rehabilitation[15-18].

In summary, acupuncture plus occupation therapy is an effective method to improve upper limb motor function in spastic CP kids. In clinical practice, comprehensive rehabilitation exercise is also recommended to improve therapeutic effect, meanwhile, intervention in early stage of CP is also very important[19-20].

**Conflict of Interest**

The authors declared that there was no potential conflict of interest in this article.

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**Statement of Informed Consent**

Informed consent was obtained from the guardians of the recruited children in this study.

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