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## 八十七年度行政院國家科學委員會專題研究成果報告

計畫中文名稱：針刺單一種穴位與同時針刺兩種不同的穴位對聽覺性內源性電位P300影響

計畫英文名稱：The effect of acupuncture stimulation on auditory endogenous potentials P300. A comparison between one kind acupoints stimulation and simultaneous two kinds acupoints stimulation

執行機構及單位：私立中國醫藥學院中醫學系

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## 中文摘要

目的：針灸在傳統上經常使用配穴的方法來治療疾病，但它的生理機轉和治療上的療效至今仍是一個謎。

材料與方法：本研究在13個自願者使用聽覺性的靶和非靶性的刺激來引發頭皮記錄的內源性電位(P300)。我們計算它們的潛伏期和振幅的變化。每個試驗者都實行三種試驗，它們之間的時間是至少一個星期。每次試驗都分成沒有針刺的控制期，隨著的是針刺期，然後是針刺後期。針灸的針被插入人體後分成：1) 非穴位組：針灸的針被插入兩側足三里穴的外側2公分的位置；2) 穴位組：針灸的針插入兩側的足三里穴；3) 配穴組：針灸的針被插入兩側的足三里穴和手三里穴的位置。

結果：我們的結果顯示穴位和配穴兩個組當針刺期和針刺後期，它們的P300的振幅都下降，而在非穴位組則沒有相同的結果。P300的潛伏期和振幅的變化在穴位和配穴組間沒有區別。

結論：針刺兩側足三里穴能導致P300振幅的變化，推測當同時接受兩種類型的感覺時，大腦皮質參與了這個感覺性的交互作用。非穴位的試驗沒有得到和穴位相同的結果，說明了所謂穴位的特殊性。配穴組的結果與穴位組相似，說明了足三里穴的生理效應與手三里穴不同。

關鍵詞：針刺，足三里穴，手三里穴，聽覺性內源性電位 (P300)

**Abstract:**

Although acupuncture has traditionally used the acupoints formula to treat diseases, the physiological mechanisms involved and the effectiveness of therapy remain unclear. This study investigated the physiological mechanisms and the physiologic response to acupuncture stimulation using the acupoints formula. Scalp-recorded potentials P300 were evoked by auditory stimulation of non-target and target in 13 normal adult volunteers. Latencies and amplitudes were measured. Three assessments were performed in each subject over a period of at least one week. Each assessment was divided into a control period with no acupuncture stimulation, followed by a acupuncture period and then a post-acupuncture period. Acupuncture needles were inserted into body as follows: 1) non-acupoint: acupuncture needles were inserted 2cm lateral to both Zusanli acupoints; 2) acupoint: acupuncture needles were inserted into both Zusanli acupoints; 3) acupoints formula: acupuncture needles were inserted into both Zusanli and Shousanli acupoints. Our results showed that both acupoint and acupoints formula assessments resulted in a significant decrease of P300 amplitudes during the acupuncture and post-acupuncture periods. However, there was significant difference in P300 amplitudes in the non-acupoint assessment during these periods. P300 changes in latencies and amplitudes were not significantly different between the acupoint assessment and the acupoints formula assessment.

We concluded that acupuncture stimulation of both Zusanli acupoints resulted in a decrease of P300 amplitudes, suggesting the involvement of the cerebral cortex in sensory interaction when simultaneous sensations of the two types are received. No similar changes were observed in the non-acupoint assessment which have been suggested to be related to so called acupoint specificity. Results obtained using the acupoints formula were not significantly different from those obtained using acupoints. These findings suggested that neuropsychological effects from stimulation of Zusanli acupoints and Shousanli acupoints are different.

Keywords: acupuncture, Zusanli acupoint, Shousanli acupoint, auditory endogenous potentials (P300)

## 前言

傳統上針灸已被使用來止痛和治療疾病，根據中國傳統醫學書籍的記載和最近研究的結論認為每個穴位都有它的特殊作用 (Ionescu-Tirgoviste et al. 1991; Abad-Alegria et al. 1995a, b)，所以在止痛或者治療疾病方面需要選擇穴位。先前的研究已經知道針刺百會穴有抑制交感神經的作用，而人中穴則有興奮的作用 (Ionescu-Tirgoviste et al. 1991)。

雖然針灸已被廣泛的使用來治療疾病但它生理機轉至今仍然不清。我們先前的研究已知大腦皮質在針灸抑制交感神經方面扮著一個非常重要的角色 (Hsieh 1998)。聽覺誘發電位P300，它是一個潛伏期介於300到400毫秒之間的正向波。P300是由大腦的許多區域所產生的 (Tarkta et al. 1995, 1996; Neshige and Luders 1988, 1992; Picton 1992)，它是一個可信賴的方法來評估大腦皮質對刺激的認知。P300活動已經廣泛的用來評估神經科和精神科疾病，如腦痴呆 (Polich et al. 1990; Goodin and Aminoff 1992; Picton 1992)，精神分裂症 (Picton 1992; Faux et al. 1993)，多發性硬化症 (Gil et al. 1993) 和視丘出血 (Onofrj et al. 1992) 等。先前的研究推測P300活動代表著與課題有關所誘發的認知過程，其關係到分辨靶和非靶的認知方面 (Goodin and Aminoff 1992; Picton 1992; Polich and Squire 1993)。此外先前的研究已指出針灸鎮痛是感覺性相互作用的結果，所以不能沒有大腦皮質的參與 (Chang 1990)。

本研究的目標有二：1)使用兩側的足三里穴來更進一步的揭開針灸作用機轉中大腦皮質的角色；2)使用兩側足三里穴和兩側的手三里穴配穴來研究針灸的治療作用，由於它們在手和足是對稱的位置。利用頭皮記錄的聽覺性內源性電位來衡量其治療上的反應。

## 材料和方法

### 對象

13個健康成人的志願者（女8，男5），它們的年齡是從20到36歲（平均值±標準差，24±4）。沒有一個受試者在研究的時間有服用任何的藥物，而且它們在實驗的時候的臨床檢查顯示沒有神經學上、精神上 and 聽力上的不正常。在參加實驗前先取得受試者的同意並將整個實驗過程完全的說明。實驗是在光亮而且隔音的房間內進行，室溫是維持在攝氏24到25度之間。當實驗的時候受試者是清醒和微閉著他們的雙眼以避免眼球運動的干擾。

### P300的記錄

記錄電極是根據國際10-20電極系統被放置於Fz, Cz和Pz的位置。監測眼球運動是將電極放置於右側眼眶的位置。參考電極是放置在兩側的耳垂。它們的電阻都是小於5千歐姆。

使用75dB強度的純張力聲音經耳機從兩耳刺激。非靶刺激是使用一個1000Hz音調的頻繁張力聲音佔試行的80%，靶刺激是使用一個2000Hz音調的稀罕張力聲音佔試行的20%。

P300記錄是使用Neuropack Four Mini的平均器（光電，東京，日本），它的遮蔽帶設定在0.1Hz和100Hz。每一試行總共30個靶刺激反應被平均。分析時間是1秒，其中前100毫秒是刺激前基準線。每一試驗，試行都被重複至少兩次來確定再現性。刺激間隔是兩秒。我們要求受試者心算靶刺激的數，儘當靶刺激的數字是準確時所得的資料才被列入分析。我們計算潛伏期介於250到400毫秒的陽性波形的潛伏期和振幅。潛伏期的計算是從刺激到頂點，而振幅的計算是從刺激前基準線到頂點。

### 實驗過程

P300記錄被分成三個試驗，為了避免針灸的殘餘效應，它們之間間隔是至少一個星期。每個試驗都分成三個期如下：1)控制期（CP）：建立針刺前的基準P300記錄；2)針刺期（AP）：針灸的針被插入於兩側足三里穴，或兩側手三里穴，或兩側足三里穴外側2公分的位置；3)針刺後期：完成針刺期P30記錄之後，針立即被拔出，經30分鐘之後再記錄P300。

本研究被分成三種試驗如下：A)非穴位組：針被插入旁開兩側足三里穴2公分的位置，使用與足三里穴相同的手法；B)穴位組：針被插入兩側的足三里穴；C)配穴組：針插入兩側的足三里穴和手三里穴。

### 統計分析

Friedman's test被使用來決定每個評估的控制期、針刺期和針刺後期P300的潛伏期和振幅的差異。我們認為 $P < 0.05$ 是有意義差。Tukey's test被使用來鑑定三種試驗彼此間的差異。我們認為 $P < 0.05$ 是有意義差。

## 結果

### 聽覺性刺激所誘發P300波形的特徵

聽覺性非靶刺激在頭皮上Fz, Cz和Pz位置所記錄的P300, 其波形的特徵是一個向上的陰性波 (N1) (Fig. 1), 而聽覺性靶刺激所得的P300波形的特徵是開始一個向上的陰性波 (N1), 隨著是一個陽性波 (P2), 然後一個陰性波 (N2), 接著是一個巨大的陽性波 (P300) (Fig. 1-4)。在同一受試者(Fig. 2-4), 雖然他的三種試驗的P300波形稍微不同, 但它們都由相似的N1-P2-N2-P300成份所構成。而且它們的平均潛伏期和振幅都與控制期很相似(Table 1-2)。

### 針灸刺激對P300的效應

我們的結果顯示P300的潛伏期在控制、針刺和針刺後期三期之間和三種評估之間都很相似(Table 1, 3)。

Fz、Cz和Pz位置所記錄的P300的振幅在穴位和配穴試驗的針刺期和針刺後期都呈現有意義的減小(Table 2, Fig. 3-4), 但在非穴位的組則沒有相似的變化(Table 2, Fig. 2)。

### 配穴對P300的效應

我們的結果顯示配穴所導致P300潛伏期和振幅的變化很相似穴位的評估(Table 1-4, Fig. 3-4)。P300振幅的減少在穴位組和配穴組兩者之間沒有差異。

## 討論

### 大腦皮質參與針刺的生理機轉

我們的結果顯示針刺兩側足三里穴可以導致P300振幅的減少, 推測在針刺生理過程中大腦皮質扮演著關鍵的角色。我們的猜想被先前的研究認為P300代表著訊息的轉換到意識狀態 (Picton 1992) 和認知功能 (Neshige and Luders 1988; Goodin and Aminoff 1992), 以及其來自腦的許多區域包括顳葉中部, 海馬, 海馬旁區, 額葉下部 (Neshige and Luders 1988; Picton 1992; Tarkta et al. 1995, 1996) 所支持。接受訊息傳遞的量關係到P300的振幅 (Picton 1992)。先前的研究已知 serotonergic 系統可以調節P300的成份 (Ito et al. 1990), 它也關係到針刺止痛 (Tsai et al. 1989)。另外, 一些研究已猜想針刺止痛是不同種類的傳入衝動在中樞神經系統交互作用和整合的結果 (Clark and Yang 1974; Chang 1980), 以及嗅覺和體性感覺可以在大腦皮質發生交互作用 (Livermore et al. 1992)。大腦皮質在體性感覺的傳入扮演一個關鍵的角色 (Wen et al. 1988; Abad-Alegria et al. 1995; Hsieh 1998), 因此我們推測針刺兩側足三里穴導致P300振幅的減少是由於兩種類型刺激的感覺性交互作用的結果。

### 穴位特異性和針刺效用的關係

我們的結果顯示針刺兩側的足三里穴可以導致P300振幅的減小，但非穴位的刺激則沒相似的結果。這個結果與先前的結論認為穴位有它的特異性存在相似 (Abad-Alegria et al. 1995a, b)。

同時針刺兩側的足三里穴和手三里穴不能導致更大的生理效應

我們的結果顯示同時針刺兩側的足三里穴和兩側的手三里穴所導致的P300振幅減少與單獨針刺兩側足三里穴所得到的相似，這些結果與先前的研究認為穴位有它的特異性一致 (Ionescu-Tirgoviste et al. 1991; Abad-Alegria et al. 1995a, b)。

我們的結論是針刺兩側足三里穴能導致P300振幅的變化，推測當同時接受兩種類型的感覺時，大腦皮質參與了這個感覺性的交互作用。非穴位的試驗沒有得到和穴位相同的結果，說明了所謂穴位的特殊性。配穴組的結果與穴位組相似，說明了足三里穴的生理效應與手三里穴不同。

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Table 1. Changes in P300 latencies during the control, acupuncture and post-acupuncture periods (msec)

	CP	AP	PP
<b>Fz</b>			
Non-acupoint	333.5±21.8	335.7±23.9	334.6±22.3
Acupoint	335.2±20.2	334.3±23.8	334.3±16.8
Acupoints formula	330.5±15.3	331.7±16.6	333.1±18.7
<b>Cz</b>			
Non-acupoint	331.7±27.4	333.9±29.5	333.9±28.1
Acupoint	333.9±18.7	332.9±22.9	333.7±17.9
Acupoints formula	328.8±19.0	329.2±21.1	330.5±25.3
<b>Pz</b>			
Non-acupoint	332.0±30.1	333.9±33.5	331.5±33.1
Acupoint	334.0±19.8	334.6±23.1	332.0±23.8
Acupoints formula	330.6±25.8	330.6±25.8	332.3±28.4

Abbreviations: In this and subsequent tables

CP= Control period; AP= Acupuncture period; PP= Post-acupuncture period

Non-acupuncture= Acupuncture needles were inserted into non-acupoint; Acupoint=

Acupuncture needles were inserted into both Zusanli acupoint; Acupoints formula=

Acupuncture needles were inserted into both Zusanli and Shousanli acupoints.

The values are given as mean ± SD.

Table 2. Changes of P300 amplitudes during the control, acupuncture and post-acupuncture periods ( $\mu$  V)

	CP	AP	PP
Fz			
Non-acupoint	18.6 $\pm$ 15.0	18.5 $\pm$ 13.5	20.3 $\pm$ 14.2*#
Acupoint	17.1 $\pm$ 11.3	10.4 $\pm$ 5.0**	11.9 $\pm$ 6.0**
Acupoints formula	17.6 $\pm$ 8.7	12.7 $\pm$ 5.2**	14.3 $\pm$ 8.1**
Cz			
Non-acupoint	19.1 $\pm$ 15.8	18.5 $\pm$ 15.5	20.2 $\pm$ 16.4
Acupoint	19.2 $\pm$ 10.2	13.7 $\pm$ 7.7**	14.0 $\pm$ 8.3**##
Acupoints formula	19.0 $\pm$ 8.9	14.6 $\pm$ 7.2**	15.4 $\pm$ 9.0**
Pz			
Non-acupoint	22.2 $\pm$ 15.3	20.5 $\pm$ 14.8	21.6 $\pm$ 14.4
Acupoint	22.6 $\pm$ 10.1	17.2 $\pm$ 7.7**	17.8 $\pm$ 8.3**
Acupoints formula	22.1 $\pm$ 8.1	17.5 $\pm$ 7.6**	17.6 $\pm$ 7.8**

Abbreviations:

\* P < 0.01, \*\* P < 0.001 compared with the values of CP

# P < 0.01, ## P < 0.001 compared with the values of AP

The values are given as mean  $\pm$  SD.

Table 3. Changes of P300 latencies during the control, acupuncture and post-acupuncture periods (msec)

Period	Non-acupoint	Acupoint	Acupoints formula
Fz			
AP - CP	2.2±8.1	-0.9±6.6	1.2±4.4
PP - CP	1.1±10.7	-0.9±13.8	2.6±8.6
PP - AP	-1.1±11.6	0.0±15.5	1.4±9.4
Cz			
AP - CP	2.2±9.1	0.9±7.8	0.5±4.6
PP - CP	2.2±7.5	0.2±11.8	1.7±11.3
PP - AP	0.0±10.2	0.8±14.0	1.2±9.2
Pz			
AP - CP	1.9±9.0	0.6±4.9	0.0±3.7
PP - CP	-0.5±10.4	-2.0±11.2	1.7±8.8
PP - AP	-2.3±8.8	-2.6±11.6	1.7±7.8

The values are given as mean ± SD.

Table 4. Changes of P300 amplitudes in the control, acupuncture and post-acupuncture periods ( $\mu$  V)

Period	Non-acupoint	Acupoint	Acupoints formula
Fz			
AP - CP	-0.1 $\pm$ 2.5	-6.7 $\pm$ 7.8*	-4.9 $\pm$ 5.7*
PP - CP	1.7 $\pm$ 2.7	-5.2 $\pm$ 7.9**	-3.3 $\pm$ 4.1**
PP - AP	1.8 $\pm$ 2.8	1.5 $\pm$ 2.0	1.6 $\pm$ 4.5
Cz			
AP - CP	-0.6 $\pm$ 2.7	-5.5 $\pm$ 3.5**	-4.5 $\pm$ 3.1**
PP - CP	1.1 $\pm$ 3.1	-5.2 $\pm$ 3.4*	-3.7 $\pm$ 3.4*
PP - AP	1.7 $\pm$ 2.4	0.3 $\pm$ 1.5	0.8 $\pm$ 3.3
Pz			
AP - CP	-1.7 $\pm$ 2.8	-5.4 $\pm$ 3.1*	-4.7 $\pm$ 3.0*
PP - CP	-0.6 $\pm$ 2.3	-4.8 $\pm$ 2.7*	-4.5 $\pm$ 3.4*
PP - AP	1.1 $\pm$ 3.0	0.6 $\pm$ 2.4	0.14 $\pm$ 3.7

Abbreviations:

\* P < 0.01, \*\* P < 0.001 compared with the values of Non-acupoint.

The values are given as mean  $\pm$  SD.

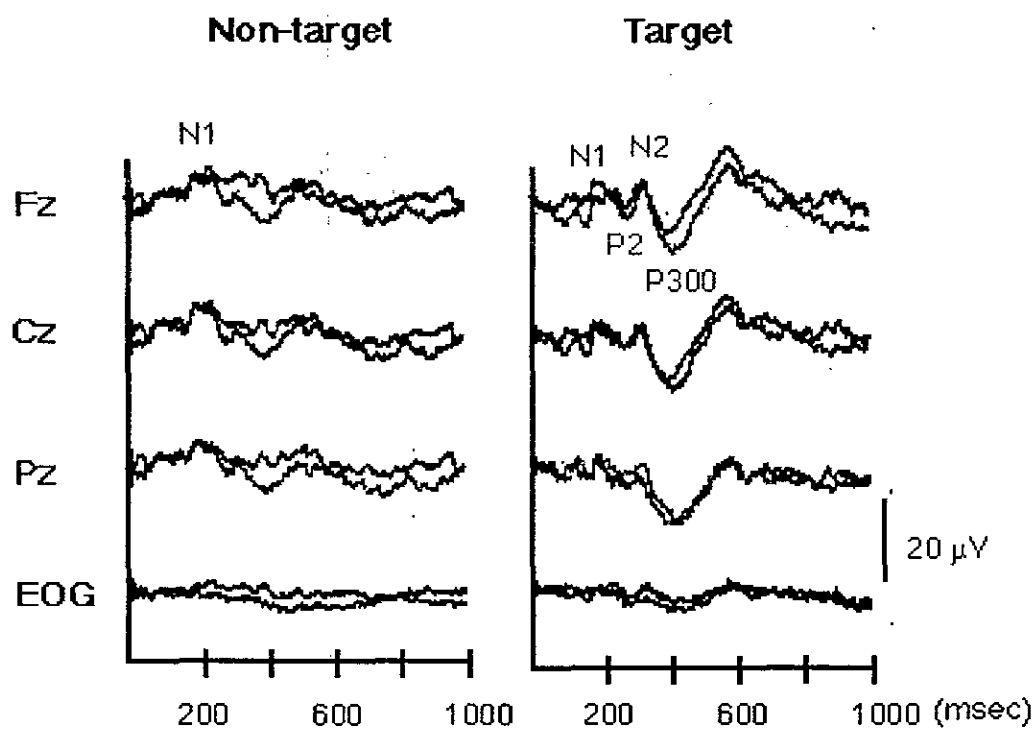


Fig. 1. P300 recorded from the Fz, Cz and Pz positions of the scalp in a 22-year-old man evoked by auditory stimulation of the non-target (left) which results in a major negative wave (N1), evoked by auditory stimulation of the target (right) which recorded an initial negative wave (N1), followed by a positive wave (P2), then a negative wave (N2) following a giant positive wave (P300). Eye movements were monitored during the test (EOG).

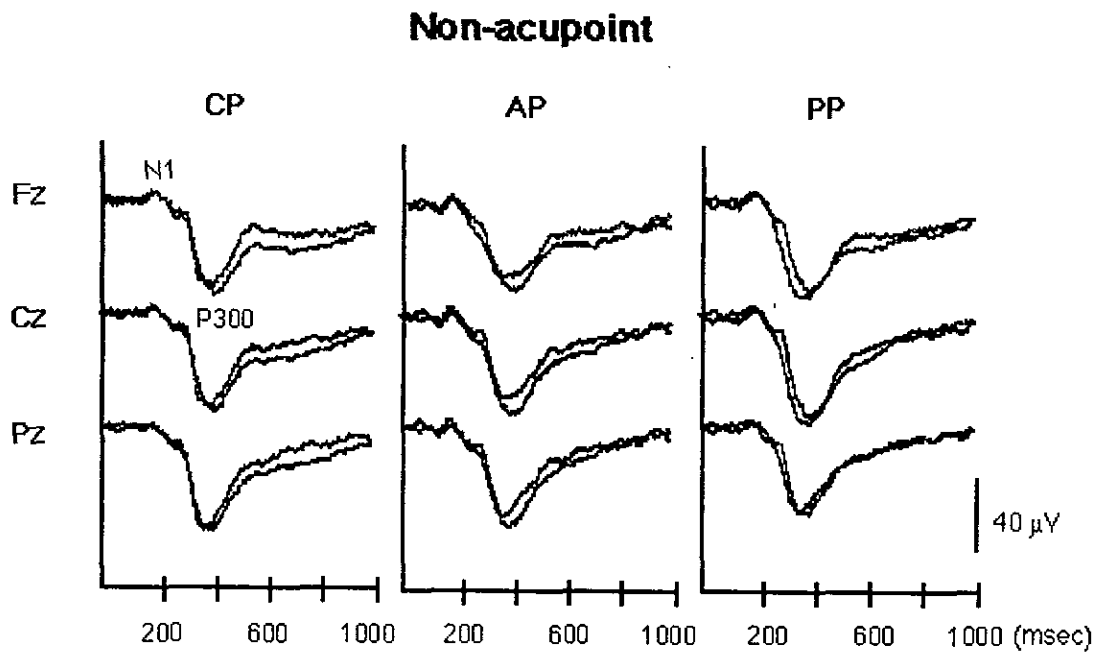


Fig. 2. P300 values evoked by auditory stimulation of the target were recorded from the Fz, Cz and Pz positions of the scalp in a 21-year-old female. Acupuncture needles were inserted 2cm lateral to the Zusanli acupoint. No prominent changes in P300 amplitudes during the control period (CP), acupuncture period (AP) or post-acupuncture period (PP).

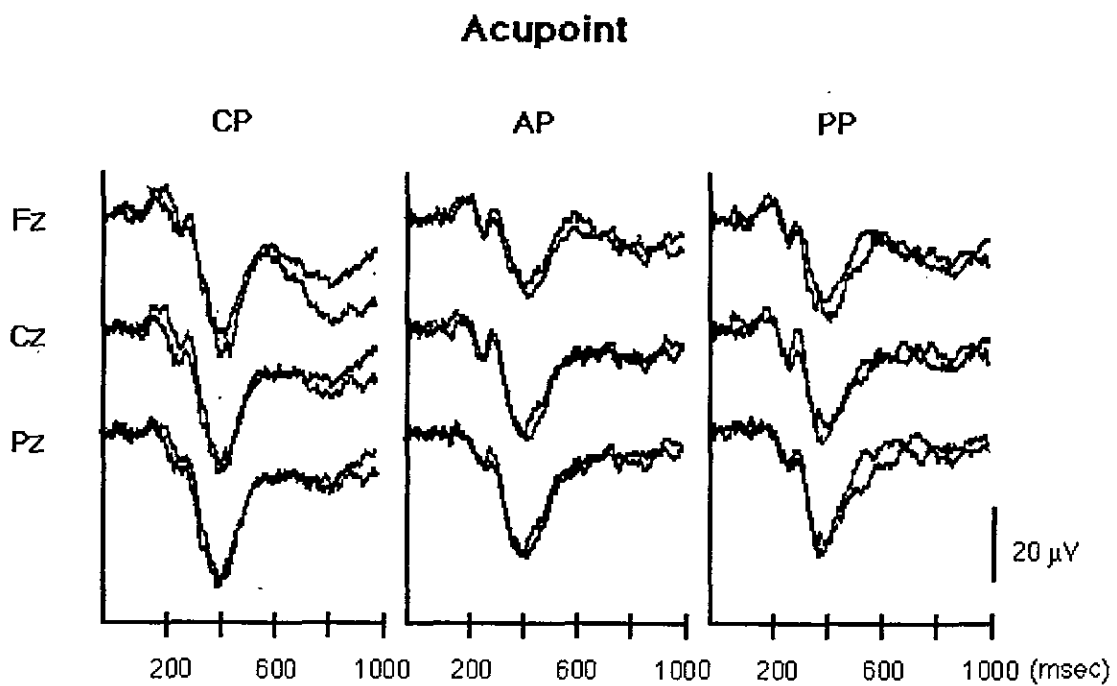


Fig. 3. P300 recordings in the same subject as in Fig. 2. Acupuncture needles were inserted into both Zusanli acupoints. P300 amplitudes clearly decreased during the acupuncture period and post-acupuncture period.

## Acupoints formula

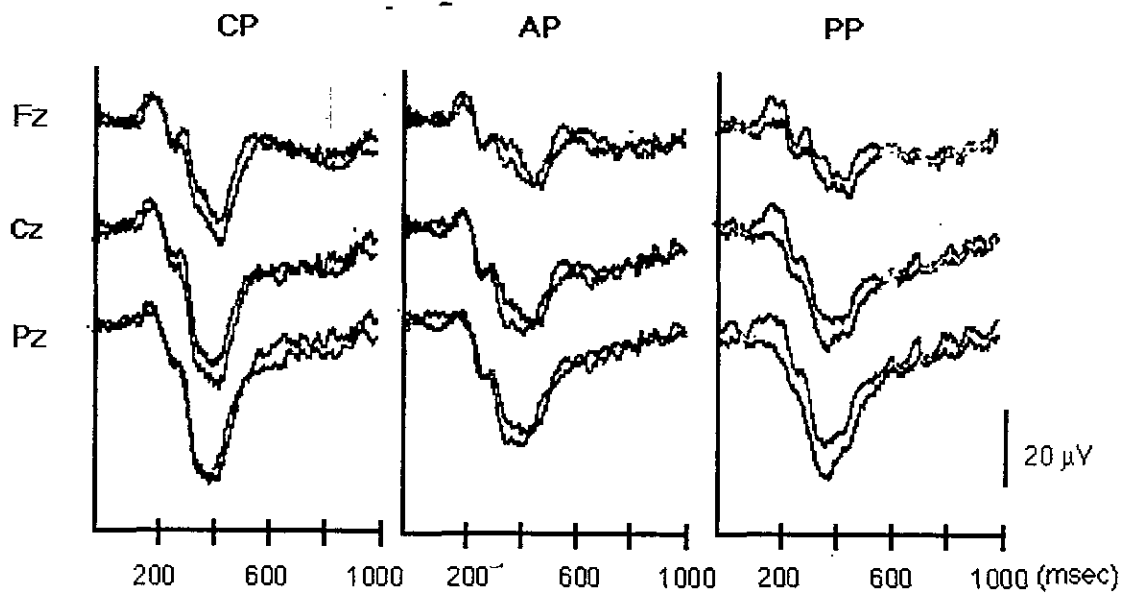


Fig. 4. P300 recordings in the same subject as in Fig. 2. Acupuncture needles were inserted into both Zusanli acupoints and both Shousanli acupoints. P300 amplitudes changed in a similar manner to Fig. 3 during the acupuncture period and post-acupuncture period.