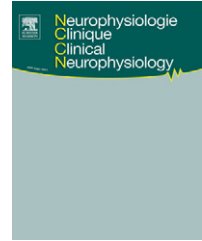




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ORIGINAL ARTICLE/ARTICLE ORIGINAL

# Effects of acupuncture needle penetration on motor system excitability

*Effets de l'insertion d'une aiguille d'acupuncture sur l'excitabilité du système moteur*

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## Summary

**Objectives.** – Transcranial magnetic stimulation (TMS) studies reported changes in motor evoked potential amplitude after acupuncture needling both at traditional acupoints and non-acupoints. However, the effects of needle penetration per se have not yet been investigated with TMS. The present study aimed at exploring effects of deep manual acupuncture needling compared to a state-of-the-art, non-penetrating control condition on several standard TMS measures of motor system excitability.

**Methods.** – Twenty healthy volunteers received both verum and sham acupuncture applied at the acupoint GB 34 near the right knee, using a crossover design. A needle with a retractable tip ("Streitberger needle") was used as sham condition to minimize non-specific effects. TMS parameters (resting motor threshold, active motor threshold, cortical silent period, short intracortical inhibition, and intracortical facilitation) were calculated from the abductor digiti minimi (ADM) of both hands 15 min before and after needling by a researcher blind to the treatment condition.

**Results.** – Verum compared to sham acupuncture significantly increased resting motor threshold. No significant treatment effect was found for any other measure, though cortical silent period and intracortical facilitation showed trends to increase in the hemisphere contralateral to the needling site after verum acupuncture.

**Conclusions.** – These results suggest a subtle but specific inhibitory effect of acupuncture needle penetration at acupoint GB 34 on motor system excitability. Further investigations should be performed with a particular emphasis on the measurements of resting motor threshold, cortical silent periods and intracortical facilitation.

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**MOTS CLÉS**

Stimulation magnétique transcrânienne ;  
Excitabilité corticale ;  
Aiguille de Streitberger ;  
Acupuncture ;  
Douleur

**Résumé**

*Buts de l'étude.* — Des études utilisant la stimulation magnétique transcrânienne (SMT) ont montré des modifications d'amplitude des potentiels évoqués moteurs après implantation d'aiguilles d'acupuncture, aussi bien dans les points d'acupuncture traditionnels qu'en d'autres endroits. On n'a cependant jamais investigué par SMT les effets spécifiques de la pénétration de l'aiguille. Le but de cette étude est de comparer, au moyen de différentes mesures d'excitabilité corticale réalisées au moyen de la SMT, les effets de l'application réelle d'une aiguille d'acupuncture à une condition contrôle où, toutes conditions étant égales par ailleurs, aucune insertion n'a lieu.

*Méthodes.* — Des aiguilles d'acupuncture réelles et « placebo » ont été successivement appliquées sur le point d'acupuncture GB34 (voisin du genou droit) chez 20 sujets volontaires sains, selon un paradigme de type « crossover ». Afin de minimiser les effets non spécifiques, une aiguille à extrémité rétractile (aiguille de Streitberger) fut utilisée pour la condition placebo. Les réponses aux SMT ont été recueillies au niveau des abducteurs du cinquième doigt des deux mains. Les paramètres suivants ont été mesurés : seuil d'obtention des réponses motrices au repos et sous activation volontaire, la période de silence corticale, la facilitation intracorticale. L'examineur ignorait dans quelle condition les enregistrements étaient réalisés.

*Résultats.* — Une augmentation significative du seuil moteur au repos fut observée en conditions réelles par rapport au placebo. Aucun autre effet significatif ne fut constaté, mais bien une tendance non significative de la période de silence corticale et de la facilitation intracorticale uniquement dans l'hémisphère cérébral controlatéral par rapport au site d'insertion de l'aiguille réelle.

*Conclusions.* — Nos résultats suggèrent que l'insertion d'une aiguille d'acupuncture dans le point GB34 exerce un effet inhibiteur discret, mais spécifique sur l'excitabilité du cortex moteur. Ils démontrent l'intérêt potentiel d'études menées sur de plus grands groupes, avec une attention particulière portée sur les mesures du seuil moteur au repos, des périodes de silence cortical et d'inhibition intracorticale.

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**Introduction**

Acupuncture has become a widespread therapy, although its proposed mechanisms of action remain under debate [4]. Transcranial magnetic stimulation (TMS) offers the potential to non-invasively characterize central nervous system mechanisms of acupuncture in conscious humans. In detail, a magnetic pulse is used to trigger neuronal discharges in the motor cortex, while motor evoked potentials (MEPs) are recorded at a target muscle. Several single- and paired-pulse TMS protocols provide the opportunity to characterize different aspects of motor system excitability [5]. Based on these parameters, TMS has successfully been used to characterize the neurobiological actions of central active drugs [13,15].

Until now, three studies investigated the effects of acupuncture on TMS measures of motor system excitability. The first study indicated side specific MEP amplitude differences after acupuncture [7], whereas the second [8] reported an effect, which depended on treatment time and outlasted acute needling. The third study characterized by the largest sample size ( $n=15$ ) replicated the aforementioned results and provided evidence for a non-peripheral effect, since acupuncture of the lower limbs affected MEP amplitudes recorded from the upper limbs [9].

However, all three studies used deep needling at non-acupoints — i.e. spots not described and used in traditional acupuncture — as a control condition. Most intriguing the latter study found acupuncture at acupoints and

non-acupoints to be equally effective in inducing changes in MEP amplitude. In keeping with a large clinical trial [3], this suggests that needling alone might cause the acupuncture effect — independent of the needling location. These findings underline that needle insertion and/or manipulation state potential confounding factors of utmost relevance in the study of acupuncture. Nevertheless, up to now, no study has been published investigating the effects of needling on motor system excitability, using a non-penetrating control condition.

Moreover, the mentioned studies were restricted to a single TMS parameter represented by the MEP amplitude. The use of other TMS parameters could provide additional information on facilitatory and inhibitory mechanisms of acupuncture. Extending TMS measures to short intracortical inhibition (SICI) and intracortical facilitation (ICF) may even help precise the location of such mechanism, since these measures reflect excitability changes within the cerebral cortex only.

The present study aimed to explore effects of deep acupuncture needling on motor system excitability, using a state-of-the-art, non-penetrating sham condition and applying the TMS parameters resting motor threshold (rMT), active motor threshold (aMT), cortical silent period (CSP), SICI and ICF. In line with earlier studies [9], this study focused on central effects of acupuncture, thus needling was performed at the lower limbs and MEP recordings were retrieved from the upper limbs, to rule out the influence of local effects.

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