MATTERS ARISING

Magnetic evoked responses elicited in the frontalis muscle

A recent paper by Kandler and Jarrat¹ describes a method for eliciting magnetic evoked potentials (MEP) from the frontalis muscle by transcranial magnetic stimulation (TCMS). Comparison of MEP latency values in normal controls and patients with Bell's palsy indicates that their prolongation beyond the fiduciary limits predicts that functional recovery will be poor.

Evocation of MEP from the facial muscle by TCMS has been the subject of several recent studies, all of which have pointed to the possibility of eliciting responses similar to the blink reflex, especially from the superior muscles.²⁻⁴ Cruccu *et al*² have described TCMS-induced frontalis MEPs whose latency range differs from that of the R1 component of blink reflex.

We carried out a study in 5 healthy volunteers (4 women, 1 man) age ranged 26-38 years, to evaluate if the R1 response obtained following electrical stimulation of the supraorbital nerve showed statistical difference in latency with the MEPs recorded in the frontalis muscle.

TCMS was supplied by a Cadwell MES-10 coil ID 9.5 cm; peak magnetic flux (centre of coil) 2 Tesla. Optimum results were obtained with the coil centre 4 cm anterior to CZ (10-20 international system). Slight shifting was occasionally necessary to adjust to skull conformation and the response amplitude. Between 70% and 90% of the maximum flux capacity was delivered to the resting subject. Latency (defined as the interval between the beginning of the stimulus artefact and onset of the first component

of the evoked muscle potential) was calculated with a Multibasis apparatus (Esaote Biomedica) from the average of at least four analysed and amplified responses (band-pass 200-10,000 Hz).

A pair of Ag/Cl skin surface electrodes (cup diameter 10 mm) were used. The recording electrode was placed on the frontalis muscle, the reference electrode on the nasal bone. Both frontalis muscles were explored simultaneously.

The latency of the R1 and R2 components of the blink reflex was also evaluated by electrical stimulation of the right supra-orbital nerve (figure). A blink reflex was always obtained. The mean (SD) ipsilateral R1 and R2 latencies were 10.52 (0.69) and 31.36 (0.77) ms respectively; that of the contralateral R2 was 32.9 (1.8) ms.

An early and a late bilateral response to TCMS were always observed (figure). Their latency times were: right 10.71 (0.64) and 30.92 (3.4) ms; left 10.62 (0.52) and 32.46 (4.4) ms. Student's *t* test for paired data showed that there was no significant difference between these values and those of the R1 and R2 components of the blink reflex. The morphology of the two responses was also similar to that of these components. Short and long latency responses could not be modified by the slight preinnervation of the muscle.

Blink reflex-like responses evoked in this way could stem from stimulation of the proprioceptors of the masseter muscle,³ since contraction of this muscle can be induced by TCMS near the vertex. Another possibility is that TCMS excites the supraorbital nerve at the foramen, or that it activates the roots of the trigeminal nerve. An explanation would thus be found for the bilaterality of the early response obtained by TCMS and the comparable TCMS and electrical stimulation latency times.

Our data confirm that responses obtained by TCMS in the frontalis muscle do not differ in latencies from those evoked with electrical stimulation of the supraorbital nerve in the same subjects. Therefore this response may well be induced by stimulation of the trigeminal nerve, rather than true MEP.

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Kandler and Jarrat reply:

Cocito and Cassano's method differs from ours in two important respects. First, they have used a larger coil. Current density varies directly with coil diameter and so they will have stimulated a wider area of the cortex. Second, they positioned the coil frontocentrally whereas we attempted to locate the coil over the facial area of the cortex. It is therefore not surprising that they were able to record early and late trigeminal nerve responses in all normal subjects. That our method did not do so can be seen from our figure.

We recommend the use of a small diameter coil when trying to examine focal areas of the central nervous system with magnetic stimulation.

- 1 Kandler RH, Jarrat JA. Magnetic stimulation in Bell's palsy. *J Neurol Neurosurg Psychiatry* 1991;54:1022.
- 2 Cruccu G, Berardelli A, Inghilleri M, Manfredi M. Corticobulbar projections to upper and lower facial motoneurons. A study by magnetic transcranial stimulation in man. *Neurosci Lett* 1990;117:68-73.
- 3 Maccabee PJ, Amassian VE, Cracco RJ, Cracco JB, Anziska BJ. Intracranial stimulation of facial nerve in humans with the magnetic coil. *Electroenceph Clin Neurophys* 1988;70:350-4.
- 4 Benecke R, Meyer BU, Schönle P, Conrad B. Transcranial magnetic stimulation of the human brain: responses in muscles supplied by cranial nerves. *Exp Brain Res* 1988;71: 623-32.

BOOK REVIEWS

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Recent Advances in Clinical Psychiatry—7. Edited by K GRANVILLE-GROSSMAN (Pp 193; Price: £19.95). 1991. Edinburgh, Churchill Livingstone. ISBN 0-443-04499-6.

The title of this volume, the 7th in the series is a misnomer. Only a single chapter, on molecular and clinical genetics in relation to psychiatric diseases can truly be said to address recent advances. The remaining 10 chapters cover disparate areas of clinical interest that range from suicidal behaviour in children and adolescents to a review of psychiatric aspects of the mouth and face. Furthermore, a whole chapter is devoted to a review of what are termed "key papers covering the years 1989 to 1990".

This therefore is a book that cannot be recommended to readers wishing to keep abreast of recent developments in psychiatry. Perhaps a change of title that actually reflects the contents, such as *Reviews of Current Clinical Practice in Psychiatry* might be appropriate for future issues.

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Fractures of the Thoracic and Lumbar Spine. By STANLEY D GERTZBEIN (Pp 293; Price: £62.00). 1992. London, Williams & Wilkins Ltd. ISBN 0-683-03490-1.

This book sets out to provide basic information and current thinking on the care of patients with spinal injuries.

In general, the book suffers from the lack of proper trials of different forms of operative and non-operative treatment that prevails in

Figure Bilateral responses obtained by electrical stimulation (A, B) and TCMS (C, D) from the frontalis muscle of a 30 year old woman. A, B: ipsilateral R1, R2 and contralateral R2 responses recorded with cathode placed over the right supraorbital foramen. C, D: TCMS responses evoked by coil placed 4 cm anterior to CZ. Early and late responses were observed on both sides with TCMS. The arrow shows the M response of the frontalis muscle elicited by TCMS of the facial nerve in the intracranial segment.