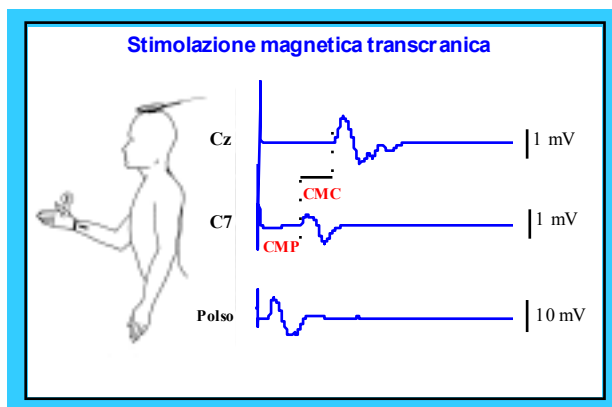


LA STIMOLAZIONE MAGNETICA TRANSCRANICA

GIAMPIETRO ZANETTE

Clinica Neurologica
Dipartimento di Scienze Neurologiche e della Visione
Università di Verona



LA STIMOLAZIONE MAGNETICA TRANSCRANICA

1. Stimolo singolo (single pulse-TMS)

- Conduzione fascio cortico-spinale
- Eccitabilità corticale (soglia)
- Periodo silenzioso
- Rappresentazione corticale (mappaggio)

2. Stimolo doppio (paired-TMS)

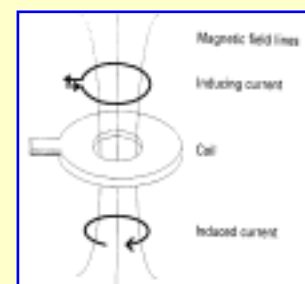
- Eccitabilità intracorticale

3. Stimolo ripetitivo (repetitive TMS)

- Modulazione funzioni corticali
- Modulazione dell'umore

STIMOLATORE MAGNETICO

- ✓ Capacitatore
- ✓ Accumulo di 5.000 Ampere
- ✓ Erogazione pulsata in 100-200 μ sec
- ✓ Fase di scarica = 5.000.000 W
- ✓ 1000 case in 1/1000 di sec
- ✓ Campo magnetico di 2-25 TESLA



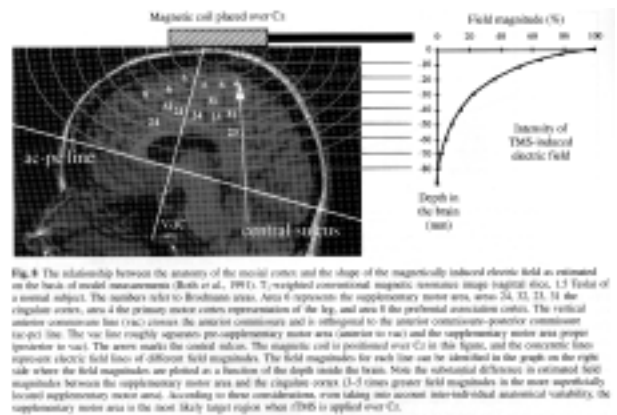
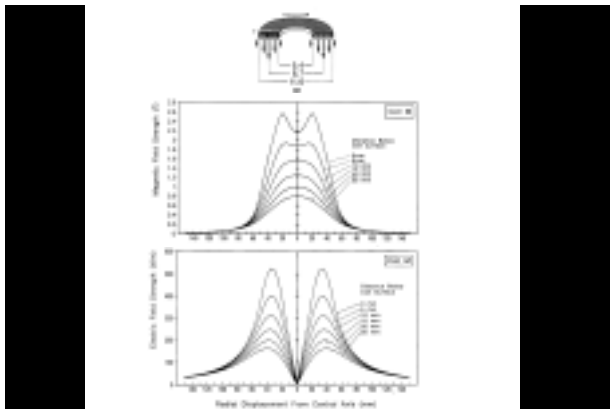


Fig. 15 The relationship between the anatomy of the central sulci and the shape of the magnetically induced electric field as estimated on the basis of model measurements (Roth et al., 1991). 7-weighted conventional magnetic resonance image (axial slice, 1.5 T) of a normal subject. The numbers refer to Brodmann areas. Area 6 represents the supplementary motor area, areas 24, 32, 33, 34 the cingulate cortex, area 4 the primary motor cortex representation of the leg, and area 8 the prefrontal association cortex. The vertical anterior commissure line (vac) crosses the anterior commissure and is orthogonal to the anterior commissure-posterior commissure (ac-pc) line. The vac line roughly separates pre-supplementary motor area (anterior to vac) and the supplementary motor area (posterior to vac). The arrow marks the central sulci. The magnetic coil is positioned over C₂ in this figure, and the concentric lines represent electric field lines of different field magnitudes. The field magnitudes for each line can be identified in the graph on the right side where the field magnitudes are plotted as a function of the depth inside the brain. Note the substantial difference in estimated field magnitudes between the supplementary motor area and the cingulate cortex (3–5 times greater field magnitudes in the more superficially located supplementary motor area). According to these considerations, even taking into account inter-individual anatomical variability, the supplementary motor area is the most likely target region when TMS is applied over C₂.

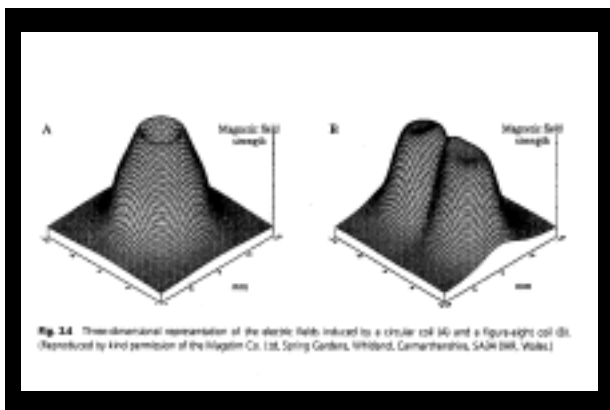
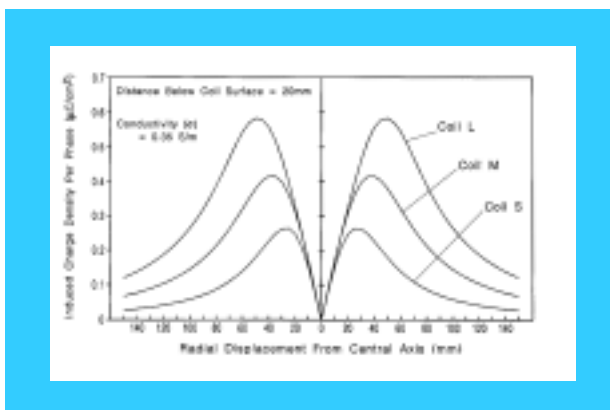
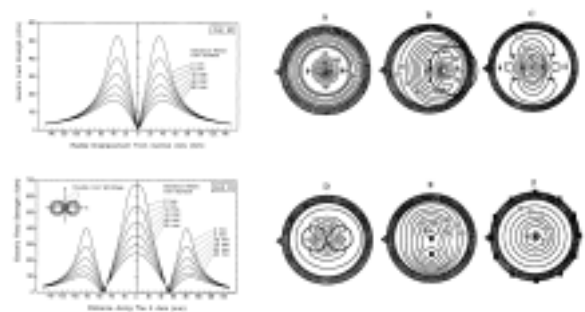
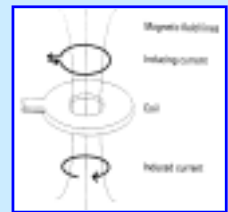
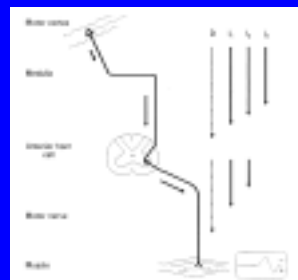
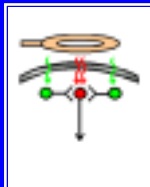
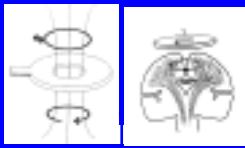


Fig. 14 Three-dimensional representation of the electric fields induced by a circular coil (A) and a figure-eight coil (B). (Reproduced by kind permission of the Huginn Co. Ltd, Spring Gardens, Whitland, Carmarthenshire, SA20 3BW, Wales.)

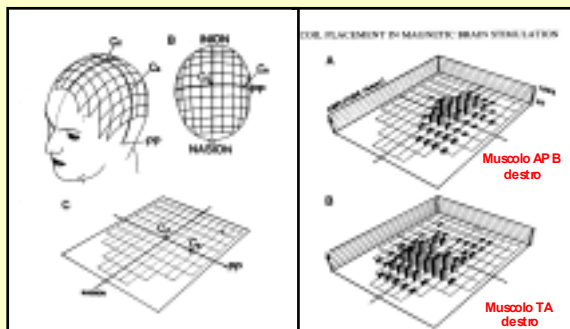


Stimolazione magnetica transcranica



Stimolatore monofasico
Senso antiorario (Lato A)
Emisfero sinistro

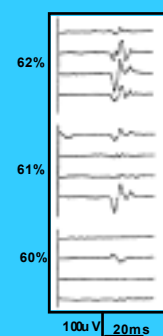
EFFETTO DEL POSIZIONAMENTO DEL COIL CIRCOLARE SULLO SCALPO



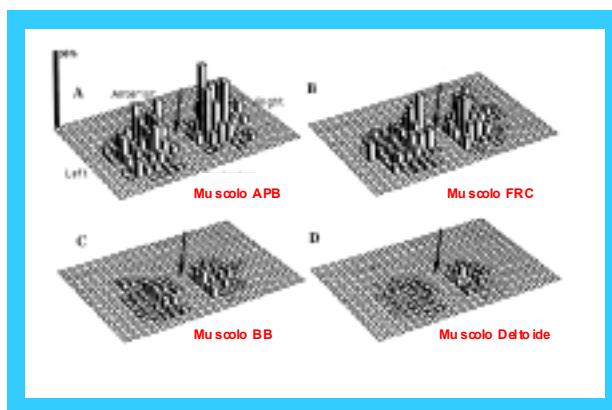
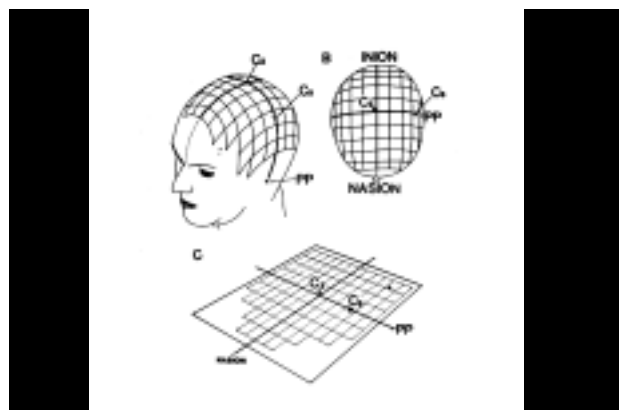
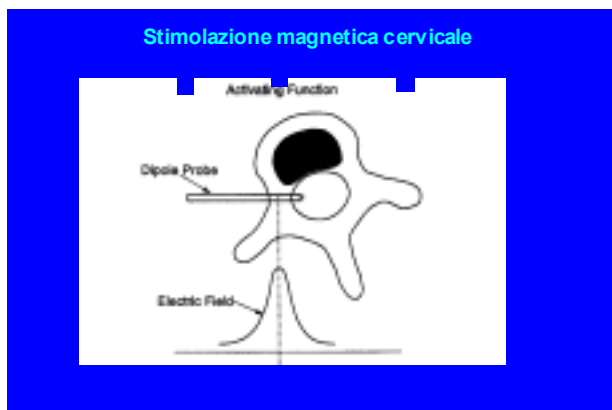
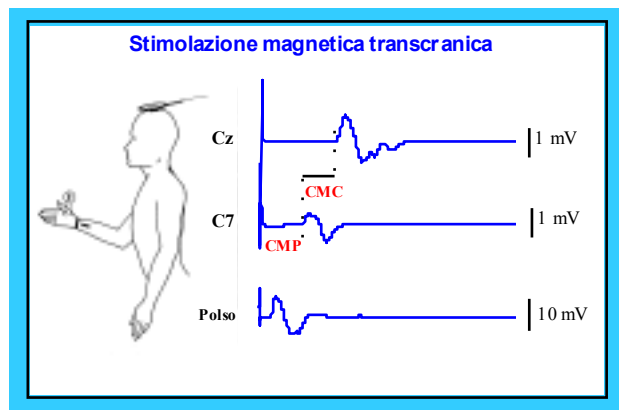
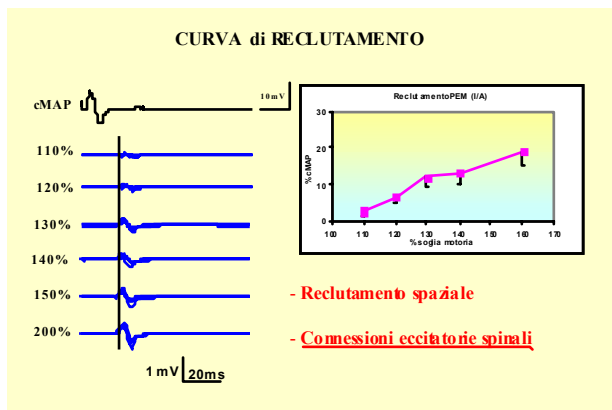
Stimolazione magnetica transcranica

1. Soglia motoria
2. Ampiezza massima del PEM
3. Curva di riduzione intensità/ampiezza
4. Conduzione motoria centrale
5. Mappaggio corticale
6. Manovre facilitatorie del PEM
7. Effetti inibitori
8. Attività inibitoria/facilitatoria corticale

SOGLIA MOTORIA

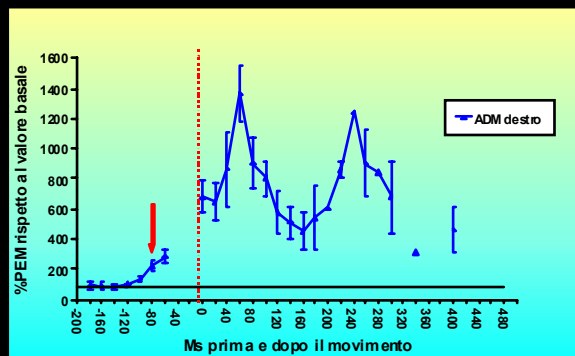
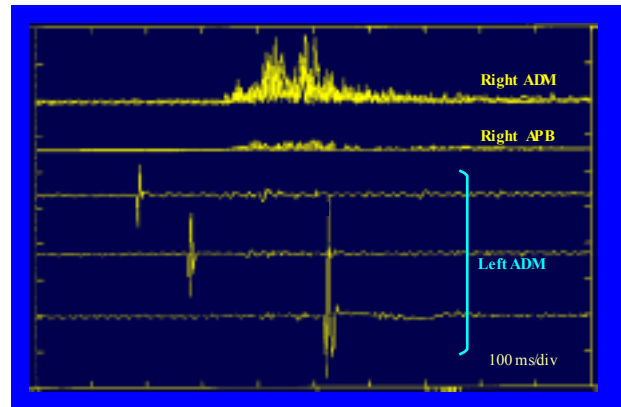
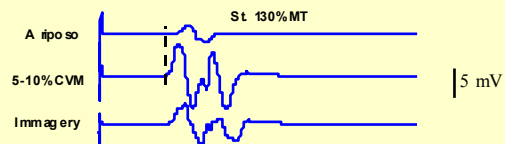


RIFLETTE L'ECCITABILITA'
DELLA MEMBRANA NEURONALE
Permeabilità agli ioni



Stimolazione magnetica transcranica

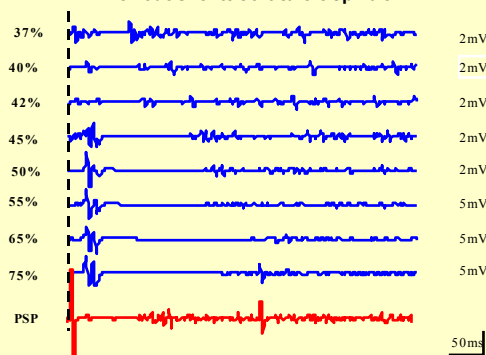
1. Soglia motoria
2. Ampiezza massima del PEM
3. Condizione motoria centrale
4. Facilitazione del PEM
5. Effetti inibitori
6. Attività inibitoria/facilitatoria corticale



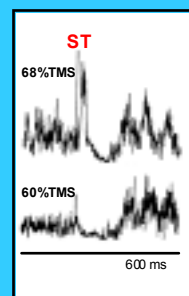
EFFETTI INIBITORI DELLA SMT

1. Funzioni motorie
 - Periodo silente
 - Inibizione transcallosale
 - Inibizione cortico-corticale
 - Aumento dei tempi di reazione
 - Interferenza con i movimenti sequenziali
2. Funzioni sensitive primarie
 - Soppressione dello stimolo cutaneo
 - Soppressione dello stimolo visivo
3. Funzioni associative
 - Interferenza con i processi di memorizzazione
 - Interferenza con il linguaggio
 - altri

Periodo silente corticale e spinale

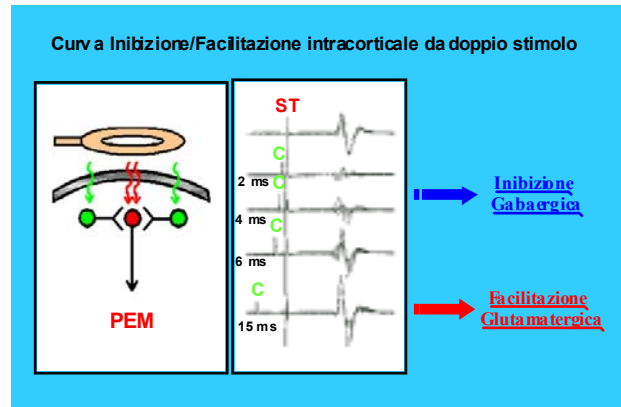


Periodo silente



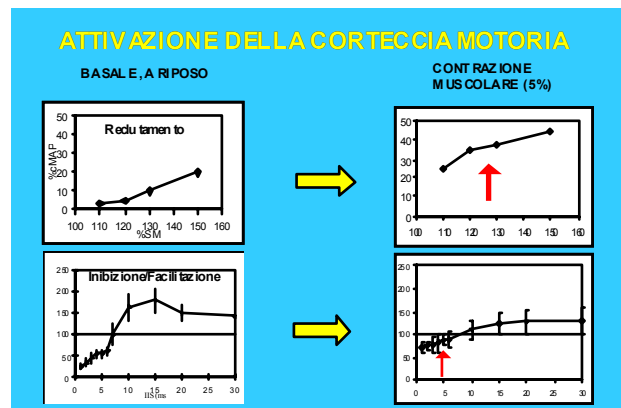
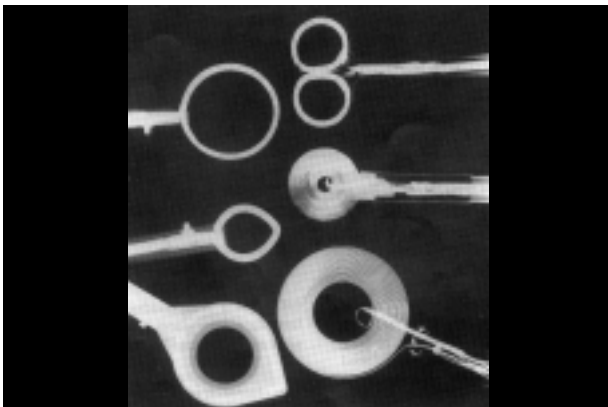
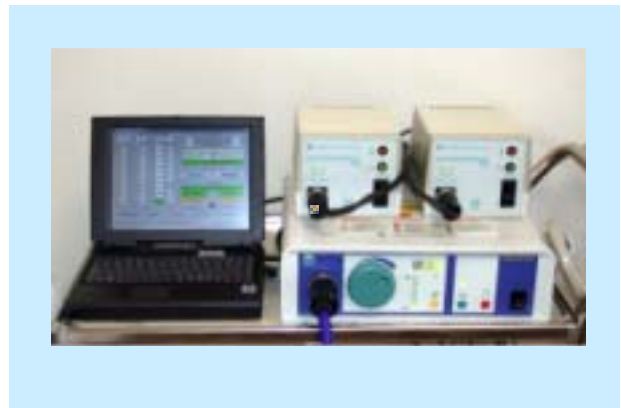
Inibizione Gabaergica

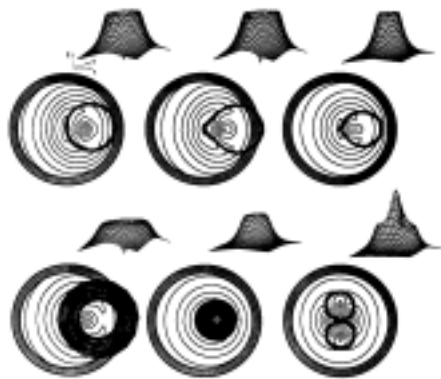
Spinale e Corticale



CONTROINDICAZIONI DELLA SMT

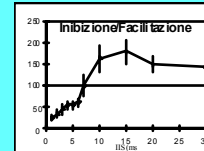
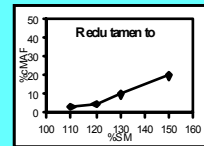
1. Pregressa craniotomia
2. Applicazioni di protesi metalliche
3. Protesi elettroniche (pace-maker)
4. Presenza di tinnitus
5. Pregresso distacco di retina
6. Epilessia ?



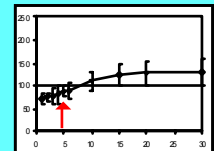
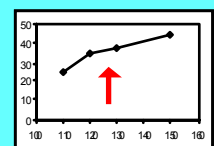


ATTIVAZIONE DELLA CORTECCIA MOTORIA

BASALE, A RIPOSO



CONTROAZIONE
MUSCOLARE (5%)



RMN funzionale

L

Movimenti sequenziali
complessi eseguiti con
la mano destra

