Combining rTMS and CIMT
A “one-size-fits-all” therapy for congenital hemiparesis?

In the past decade, we have experienced dramatic progress in the treatment of children with congenital hemiparesis. One important step was the introduction of intensive rehabilitation approaches based on principles of motor learning and neuroplasticity, such as constraint-induced movement therapy (CIMT) and intensive bimanual training. Often these approaches are implemented in socially stimulating “camp” environments.

Consequently, most studies investigating specific treatment modalities (such as CIMT or intensive bimanual training) have used highly standardized programs to investigate their effectiveness. CIMT and intensive bimanual therapies have been shown, on a group level, to be equally effective. However, there are some nuances as well as interindividual variability in treatment outcomes. This is not surprising given the variability in underlying lesions, reorganization patterns, and, related to this, diverging mechanisms of treatment-induced neuromodulation. This has led to the development of “hybrid” therapies, where a period of CIMT is followed by bimanual training. The combination of approaches may account for the unknown responsiveness to treatment on an individual level; ideally, however, we should be able to tailor a combination of treatment modalities to the individual needs and optimal benefit of the patient.

Inhibitory repetitive transcranial magnetic stimulation (rTMS) to the motor cortex of the intact contralesional hemisphere may be another potential treatment modality. The idea behind this intervention, at least in adult hemiparetic stroke, is to “weaken” the contralesional hemisphere, thereby reducing the interhemispheric inhibition of the lesioned hemisphere, so that it can become more “active.” Indeed, this concept is successful in adult stroke patients.

In this issue of Neurology, Kirton et al. report a treatment study on congenital hemiparesis due to perinatal stroke, comparing camp alone with camp + rTMS, camp + CIMT, and camp + rTMS + CIMT. They found that while all groups showed improvement, the patients who received the combination of rTMS and CIMT showed the greatest benefits.

What do we learn from this study for clinical practice? First, the study adds to the growing evidence that intensive training in this population works and that CIMT is a useful treatment modality. More important, however, this study builds on other small trials of rTMS and provides evidence that rTMS in children with congenital hemiparesis is (1) feasible, (2) safe, and (3) effective, at least on a group level, thereby paving the way toward further rTMS studies and, eventually, to its clinical application. The results also suggest that it probably makes sense to combine rTMS with other treatment modalities (here CIMT)—with the same rationale for the combination of other treatments.

However, before implementing rTMS in clinical practice, more questions need to be answered. One critical point must be looked at in more detail: in contrast to adult hemiparetic stroke patients, who normally control their paretic hands via preserved crossed corticospinal projections from the lesioned hemisphere, a substantial portion of patients with congenital hemiparesis possess fast-conducting ipsilateral corticospinal projections from the contralesional hemisphere to the paretic hand (figure). In some, these are the only projections to the paretic hand (e.g., in patients with extensive hemispheric lesions, or after hemispherectomy; figure, right). In these patients, interhemispheric inhibition between the 2 motor cortices cannot occur (there is only one), and it is, at least at first glance, counterintuitive to use rTMS to inhibit the one hemisphere controlling both hands. Of note, Kirton et al. deliberately included 20 patients in whom they found such ipsilateral projections, 11 of whom underwent rTMS. Although it was stated that no deterioration of hand function was observed, the question remains whether rTMS really is an appropriate treatment option for this subgroup of patients, and if yes, what the modes of action in this constellation might be.

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However, the idea of inhibiting the contralesional hemisphere in these patients would be compatible with findings that CIMT in patients with only ipsilateral projections led to a reduction of synaptic activity during simple hand movements (measured by fMRI) and to a reduction in transsynaptic excitability of the motor cortex (measured by single-pulse TMS). It would also be attractive to speculate that, if indeed inhibitory rTMS can be shown to be beneficial in these patients, it might act by helping to reduce the activity and excitability of the motor cortex controlling the paretic hand. We are therefore looking forward to more detailed analyses of the study by Kirton et al., which should specifically look at possible differences in the effects of rTMS (and maybe also of CIMT) on patients with contralateral and with ipsilateral corticospinal projections.

In the end, we are confident that rTMS will eventually become yet another new tool in our “toolbox” for treating congenital hemiparesis. Not unlike CIMT and bimanual therapy, we will still have to find its specific contributions, most likely together with intensive therapies, as well as interventions acting on the impairment level (e.g., botulinum toxin or splinting). As in these other approaches, it is unlikely to be a “one-size-fits-all” treatment for congenital hemiparesis.

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REFERENCES
