

## REFERENCES

1. Krings T, Töpper R, Foltys H, Erberich S, Sparing R, Willmes K, Thron A. Cortical activation patterns during complex motor tasks in piano players and control subjects. A functional magnetic resonance imaging study. *Neurosci Lett*. 2000 Jan 14; 278(3): 189-93.
2. Purdie H, Hamilton S, Baldwin S. Music therapy: facilitating behavioural and psychological change in people with stroke-a pilot study. *Int J Rehabil Res* 1997 Sep; 20 (3): 325-7.
3. Thaut MH, Leins AK, Rice RR, Argstatter H, Kenyon GP, McIntosh GC, Bolay HV, Fetter M. Rhythmic Auditory Stimulation Improves Gait More Than NDT/Bobath Training In Near-Ambulatory Patients Early Post Stroke: A Single-Blind, Randomized Trial. *Neurorehabilitation and Neural Repair* 2007; 21: 455.
4. Campbell D. *The Mozart Effect: Tapping the Power of Music to Heal the Body, Strengthen the Mind, and Unlock the Creative Spirit*. HarperCollins Publishers Inc., New York, 2001.
5. Kim SJ, Koh I. The effects of music on pain perception of stroke patients during upper extremity joint exercises. *J Music Ther*. 2005 Spring; 42 (1): 81-92.
6. Schauer M, Mauritz KH. Musical motor feedback (MMF) in walking hemiparetic stroke patients: randomized trials of gait improvement. *Clin Rehabil* 2003 Nov; 17 (7) :713-22.
7. Magee WL, Davidson JW. The effect of music therapy on mood states in neurological patients: a pilot study. *J Music Ther* 2002 Spring; 39 (1): 20-9.

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### *New approaches to stroke rehabilitation – Transcranial Magnetic Stimulations*

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Stroke is the most frequent serious neurological disorder world-wide and the third leading cause of death in industrialized countries. It has a high incidence in Europe and is commonly highly disabling.

A neurological deficit after stroke does not reflect only local dysfunction at the site of injury, but is also determined by the distributed impairment of connected neural systems that are structurally intact. This dysfunction may be reflected by diaschisis, deactivation, hyperactivity, in other words intra- and interhemispheric activity imbalance. The distributed impairment principle has been demonstrated for various deficits such as aphasia, spatial neglect, motor dysfunctions etc. It has widespread implications for the fields of neurology, neuropsychology and neurorehabilitation. Understanding of post stroke clinical syndromes in the aspect of anatomical and functional basis should be revised at present and the new knowledge on neural substrates for brain function (especially higher cortical functions) should have an impact on rehabilitation approach.

In over the past last several years, experimental preclinical studies, clinical observations, structural and functional neuroimaging studies, and neurophysiological investigations have provided greater insight into the basic mechanisms underlying neuroplasticity and recovery after stroke. Different techniques became available for the noninvasive evaluation of functional activity in the human brain and allowed to investigators to formulate questions geared to understand the mechanism underlying the ability of the human brain to reorganize and to design rehabilitation programs.

One of these techniques is Transcranial Magnetic Stimulation (TMS) developed by Barker in 1985. Consequently, it has become possible to stimulate specific cortical regions in a relatively focal manner. In 1987, repetitive TMS (rTMS) was introduced (regularly repeated TMS delivered to a single scalp position). Repetitive TMS appears to have an effect on cortical excitability that lasts beyond the duration of the rTMS applications itself. Findings to date suggest that the modulatory effects of rTMS on cortical excitability may be inhibitory or facilitatory depending on the frequency, intensity, duration and intertrain interval. A growing number of studies utilize these modulatory effects of rTMS on cortical excitability as a potential therapeutic technique in many neurological and psychiatric disorders. Discovery of this therapeutic effect of rTMS can be used to design a more rational and better focused rehabilitation treatment after stroke, for example, as a complementary treatment in speech-language therapies in aphasia or in other impaired motor and cognitive functions (Brighina et al., 2003, Murase et al., 2004, Neiser, Martin et al., 2004, 2005).