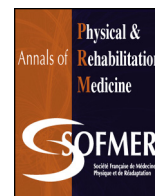




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Editorial SI music

Music, rhythm, rehabilitation and the brain: From pleasure to synchronization of biological rhythms



The ability to perceive, produce, and enjoy music is a typical human trait. Across continents, from early childhood to older age, individuals, groups and societies listen to and play music, which evokes emotions, generates pleasure, relieves stress and fosters well-being.

During the last century, the power of musical and rhythmic activities has been recognized and exploited for rehabilitation of neurological disorders. For example, the power of musical rhythm for improving gait performance in Parkinsonism was described more than 50 years ago, well before the first neurophysiologic works, which are now starting to shed light on the neuronal mechanisms underlying this effect. Similarly, the benefits of Melodic Intonation Therapy for aphasia, whereby stroke patients train their speech production by singing intonation and rhythmic tapping, thus improving their verbal expression, have been known for decades.

The last 2 decades have witnessed a surge of interest in the benefits of music-based interventions in rehabilitation [1].

The studies reviewed or reported in this Special Issue provide an update of the benefits of musical leisure activities or music- and rhythm-based interventions for cognitive, motor, emotional, and social functioning. Current applications of music and rhythm therapy in neurological rehabilitation are reported for Parkinson disease, stroke, multiple sclerosis, neurodegenerative diseases (dementia and Alzheimer disease) but also deafness, psychiatric disorders and neuro-developmental diseases. The beneficial effects of musical activities are described in the sphere of mood and neuropsychiatric symptoms. Moreover, improvements in cognitive performance based on active music interventions as well as through music listening have led to recent impressive studies on aphasia, attention, memory and visio-spatial skills such as neglect. In addition, readers can learn from recent works on motor impairment that describe music-based rehabilitation methods enhancing recovery of gait, upper-limb movements, balance and coordination. Finally, the results of clinical trials support that musical activities have an emotional and social impact in health as well as in patient populations. In a rehabilitation setting, beyond their therapeutic effects, these methods have the added value of involving social interaction, an element typically not present in more classical individual-based methods.

The beneficial effects of music-based interventions are ascribed to brain changes and plasticity. We know that music and rhythm affect our autonomic nervous and neuro-endocrine systems, but they can also activate the brain extensively, engaging multiple

temporal, frontal, parietal, cerebellar, and limbic regions. Numerous studies have investigated these neural mechanisms underlying the clinical effect of music on motor, cognitive and emotional functioning. As an example, timing and rhythmic skills have been widely studied, based on the hypothesis that these skills are underpinned by important cognitive and motor functions. The study of how rhythmic or musical stimuli modify brain functioning and enhance brain adaptation has been driven by theoretical questions in cognitive neuroscience and examined with neuroimaging, electrophysiological or behavioural methods. The effect of rhythm has been linked to theories of neurocognitive oscillations that underlie cognitive processes (e.g., memory, speech) and motor activities. The brain's oscillations have been found to be able to synchronize to temporal regularities of external stimuli, leading to a potential therapeutic effect of music on cognitive or motor symptoms. This issue provides an overview of current knowledge of these complex neurophysiologic effects of music-based interventions, based on studies conducted by world specialists in the field.

A drawback of the current state of the art in music-based interventions is the general lack of large and high-quality randomized controlled trials needed to build more solid clinical evidence to establish the use of music in rehabilitation and care units. Some randomized controlled trials are currently under way and more are needed. Moreover, studies combining behavioural outcome measures with neurophysiologic and endocrinologic markers as well as structural and functional neuroimaging methods are required to better elucidate the neural mechanisms underlying the efficacy of music interventions. Whether active music interventions could have a neuroprotective effect for neurodegenerative diseases or physiological aging is still unsolved and awaits further enquiry.

Disclosure of interest

The authors have no competing interest.

Reference

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