Altered neural oscillations and their abnormal synchronization are crucial factors in the pathophysiology of several neuropsychiatric disorders. There is increasing evidence that the perturbation with an abnormal increase of spontaneous thalamocortical neural oscillations lead to a phenomenon termed Thalamocortical dysrhythmia (TCD) which underlies the symptomatology of a variety of neurological and psychiatric disorders including Parkinson's disease, schizophrenia, epilepsy, neuropathic pain, tinnitus, major depression and obsessive-compulsive disorder. In addition, repetitive transcranial magnetic stimulation (rTMS) is a non-invasive neurophysiological tool that has been shown to both induce a modulation of neural oscillations and alleviate a wide range of human neuropsychiatric pathologies. However, little is known about the precise electrophysiological mechanisms behind the therapeutic effect of rTMS and its potential to improve abnormal oscillations across diverse neuropsychiatric disorders. Here we show, using combined rTMS and surface electroencephalography (EEG), a short lasting frequency-dependent rTMS after-effect on thalamocortical rhythmic interplay of low-frequency oscillations in healthy humans at rest. In particular, high-frequency rTMS (10 Hz) induces a transient synchronised activity for delta (5) and theta (0) rhythms thus mimicking the pathological TCD-like oscillations. In contrast rTMS 1 and 5 Hz have the opposite outcome of de-synchronising low-frequency brain rhythms. These results lead to a new neurophysiological insight of basic mechanisms underlying neurological and psychiatric disorders and a probable electrophysiological mechanism underlying the therapeutic effects of rTMS. Thus, we propose the use of rTMS and EEG as a platform to test possible treatments of TCD phenotypes by restoring proper neural oscillations across various neuropsychiatric disorders. Crown Copyright (C) 2012 Published by Elsevier Inc. All rights reserved.