

Neurophysiological Order in the REM Sleep of Participants of the Transcendental Meditation and TM-Sidhi Program

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Editor's Note: Page-count constraints and the overall nature of this issue led us to decide, with regret, that we could only republish an abstract of this meticulously documented pilot study. Readers who want detailed information including quantitative and qualitative results should contact the editor to obtain a copy of Lucidity Letter, 9(2).

Previous research has revealed that, in the course of ontogenesis, the randomly occurring, isolated, low frequency Rapid Eye Movements (REMs) of the undifferentiated sleep of the premature are gradually ordered in groups of high-frequency REMs, characteristic of mature REM sleep (Petre-Quadens, 1967; 1969; 1978; Petre-Quadens & De Lee, 1974; Petre-Quadens, De Lee & Remy, 1971). This observation has led to the hypothesis that there exist two functionally different types of REMs in REM sleep: the high frequency (HF) REMs with an interval of less than one second, reflecting the "maturity" or "order" of brain functioning; and the low frequency (LF) REMs with an interval of more than one second, reflecting "random noise" in the brain. Subsequent research has supported this hypothesis.

TM and TM-Sidhi techniques, when practised 20–40 minutes twice a day, result in improved scores on tests of cognitive and affective functioning. Improvements took place regardless of the age of the subjects, even on variables like "fluid intelligence" and "field independence," which normally do not improve after the age of 17 (Aron, Orme-Johnson & Brubaker, 1981; Dillbeck, Assimakis, Raimondi, Orme-Johnson & Rowe, 1986).

In view of these findings, it seemed appropriate to test the above described hypothesis—that the brain during REM sleep carries out information-ordering processes which are reflected in the neurophysiological patterns of the REM sleep—with subjects who are practising the TM and TM-Sidhi programs. This has been done with the following REM sleep parameters: the ratio of the HF-REMs ($I < 1$ sec) to the LF-REMs ($I > 2$ sec) (as a measure for the order-creating capacity of the brain); the density of the HF-REMs (as a measure for the intensity of the information-ordering process); the density of the LF-REMs (as a measure for the intensity of the cerebral "noise" which accompanies the information-ordering process to a certain extent); the REM density, or density of all REMs regardless of their frequency (as a measure for the intensity of the stimulation of the brain); the total number of HF-REMs (as a measure for the absolute amount of ordered information over the total REM sleep

time); the total number of LF-REMs (as a measure for the absolute amount of cerebral "noise" over the total REM sleep time); the REM sleep time (as a measure for the total efficiency of REM sleep); and the REM sleep percentage (as a measure for the total efficiency of REM sleep, in relation to total sleep).

Methods

Subjects

Six male TM-Sidhi practitioners, aged between 31 and 39, with different educational backgrounds, served as experimental subjects (Table 1). They had been practising TM for an average period of 139 months (range, 94–199 months), and the advanced TM-Sidhi program for an average period of 87 months (range, 76–96 months). All but the youngest were teachers of the TM technique. The author was one of the experimental subjects. The experimental group was part of a group of 230 male TM-Sidhi practitioners, predominantly Europeans, who resided at the TM academy in Vlodrop (Limburg, The Netherlands). There, they worked full-time and, in addition, practised an extensive TM-Sidhi program collectively. Four of the six experimental subjects reported clear experiences of the TM-Sidhis and of "witnessing" their night's sleep, and two reported less clear experiences (Table 1).

Six male subjects who did not practise any form of meditation, yoga, or similar technique for holistic development, served as control subjects. Their ages ranged between 33 and 38, and they all had had an academic education (Table 1).

All subjects were in good health. On the day preceding the measurement, none experienced intense emotions or physical discomforts, none used medicine, had alcoholic drinks, or took any additional rest in the form of sleep.

Procedure and Apparatus

Each of the subjects was measured in his own bedroom for two consecutive nights, by means of an ambulant four-channel recorder, the Medilog 4–24 of the Oxford Medical Systems. Starting two days before the measurement, the subject filled out some diary forms which were examined every day by the person who took the measurement. Measurement of the experimental group was done by the author; measurement of the control group and of the author serving as experimental subject was done by a medical student of the University of Limburg (The Netherlands). During the two months' measuring period, the experimental and control subjects were measured alternately as much as possible. Although the subjects had been measured in their own environment, a first night effect could be noticed and therefore only the second night was fully

analyzed.

Discussion

REM Ratio and the Order-Creating Capacity of the Brain: The HF-REMs/LF-REMs ratio for total REM sleep was greater in the group of TM-Sidhi practitioners in comparison with the control group, giving further support to the concept of the HF-REMs/LF-REMs ratio as an index of negative entropy in the brain. In the present study, the ratio of REMs in the group of TM-Sidhi practitioners is greater because of a greater density of the HF-REMs, which supports the concept that the development of these HF-REMs in REM sleep is indeed the result of a maturation process, in particular of the frontal cortex.

Density of HF-REMs and Clarity of Mind: A greater density of REMs during REM sleep has been found to correlate with a greater amount of information to which the subjects are exposed. Perhaps one would therefore expect in the group of TM-Sidhi practitioners of the present study a smaller REM density in REM sleep, because of the daily hours of quiet meditation practice. The fact that, on the contrary, a greater density of REMs—and in particular of HF-REMs—is found in the TM-Sidhi practitioners agrees with the interpretation that it is primarily the alertness or clarity of mind that makes one receptive to stimuli and capable of integrating this information.

REM Ratio and Independency of the Cerebral Integrating Capacity: Nevertheless, the density of REMs during REM sleep—interpreted as a measure for the stimulation of the brain—seems to remain dependent on the amount of information to which the subject is exposed. This can be deduced in the present study from the comparison of the experimental subject A with the experimental subject F. During the day preceding the analyzed night, the experimental subject A had been exposed to an unusually large amount of sensory information, whereas the experimental subject F had stayed in his routine of quiet, intellectual work. Consequently, the first showed an extremely high REM density during the REM sleep, while the latter scored the lowest (total) REM density of the whole experimental group. The difference between the two subjects was even more pronounced with regard to the total amount of HF-REMs and total amount of LF-REMs in the REM sleep. However, when the HF-REMs are placed in relation to the LF-REMs to express the cerebral integration of information, then this difference disappears and the score of the REM ratio of both these subjects attain the highest value in the study. This agrees with their strong subjective experience of the TM-Sidhis and of the maintenance of pure consciousness during their sleep (Table 1). Previous research has found enhanced information processing (ideational fluency) and EEG coherence in those with clear experiences of pure consciousness and of the TM-Sidhi techniques (Orme-Johnson & Haynes, 1981). It also illustrates the independency of this cerebral integrating capacity parameter with regard to the

amount of information to which the subject is exposed.

About 430 research studies on TM and TM-Sidhi practitioners have found physiological, psychological, or sociological data which could be interpreted in terms of greater health and maturity (For examples and summaries, see Orme-Johnson & Farrow, 1977; Wallace, Orme-Johnson & Dillbeck, 1989).

EEG Alpha Activity and Intelligence or Maturity: The subjects with a greater REM ratio have an EEG alpha activity which is more abundant and of a greater amplitude and lower frequency. This finding, again, is in accordance with the interpretation of the REM ratio as a measure for intelligence and maturity.

The TM-Sidhi group, which has the greater REM ratio, also shows a sleep spindle activity which is more abundant and displays a higher amplitude and a lower frequency. This finding—when taken together with the greater synchronization and coherence in the electrocorticogram and the improved cognitive and affective functioning in TM and TM-Sidhi practitioners—agrees with the hypothesis that both sleep spindles and REM ratio reflect the cerebral assimilation of information during sleep.

REMs and Sleep Spindles and Excitation and Inhibition: It was suggested (Petre-Quadens, 1969) that the REM activity as an excitation process is kept in balance by an equivalent spindle activity which could be considered as an inhibition process, and that therefore both activities never take place at the same time. The sleep spindles, observed during the REM bursts of REM sleep in the present study, indeed never completely coincided with the individual REMs.

Alpha Transition Stage and Transcendence: Immediately before and after sleep in all experimental subjects (except subject C) and in the control subject B, and immediately before and after each of the five sleep phases during the night in the experimental subject B, a kind of prolonged transition stage between normal waking and sleeping occurred which, with its almost uninterrupted, high amplitude alpha activity and rhythmical eye movements, showed much similarity with Transcendental Meditation. This agrees with the reports of the experimental subjects in question that the degree to which the meditative state of restful alertness (here, integrated with waking) is experienced at the beginning of the sleep determines how "pleasantly" and "refreshingly" the sleep proceeds. It is also reminiscent of the vision of Maharishi Mahesh Yogi (1967) that Transcendental Meditation eventually develops in its practitioners a fourth major state of consciousness, termed "transcendental" or "pure" consciousness, which can be clearly experienced either in its pure form during the short transition stages between waking, dreaming and sleeping or during the states of waking, dreaming and sleeping.

Conclusion

To conclude, the fact that all the group results of the present study, without any exception, show coherently, according to the definitions and findings of previous sleep research, a greater neurophysiological order in the TM-Sidhi group than in the control group, adds further support to the main hypothesis that the HF-REMs/LF-REMs ratio is a measure of the cerebral capacity to structure "order" out of "noise." The fact that the experimental values on this REM ratio were far higher than the values reported in the literature could be interpreted as indicating the onset of a new dimension of consciousness: a continuum of restful alertness, serving as a background of order, extending to the night's sleep. It would, therefore, deserve further investigation. One could use larger samples of subjects, extend the measurement to four consecutive nights, and score the REMs automatically (provided the necessary software is available). Perhaps one could also use subjects as their own controls before and after their start with the TM and TM-Sidhi programs, to measure more directly the role of this practice with respect to order or intelligence. If one places the EEG electrodes in a strictly standardized manner, and measures with a low-noise apparatus, one could simultaneously analyze the EEG signals for coherence or long-range spatial order in the brain.

Selected References

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