PAPER 302

AN INVESTIGATION INTO THE EFFECTS OF TRANSCENDENTAL MEDITATION UPON HEARING THRESHOLD

RUSSELL FRANCE

North Staffordshire Polytechnic, Stoke on Trent, United Kingdom

Research completed May 1983.

The Transcendental Meditation technique was found to lead to greater improvements in auditory thresholds than ordinary rest. Heart rate decreased during Transcendental Meditation but did not change significantly during rest.—EDITORS

The study was designed to investigate the influence of the Transcendental Meditation (TM) technique on hearing threshold, and to compare the relative influence of Transcendental Meditation and rest. A group of 29 volunteers aged between 16 and 61 were tested, all of whom were practising TM regularly. The experiment was conducted in two phases: 15 subjects rested in the first phase and meditated in the second, while the remaining 14 subjects meditated in the first phase and rested in the second. All subjects thus served as their own controls. A standard test of hearing threshold was administered to each ear separately, at frequencies of 250, 1000, and 4000 Hz, before the first phase and again immediately after each phase of the experiment.

Combining data from both ears at all frequencies, there was a mean improvement in hearing threshold between pre-test and post-rest of 1.29 dB (p = .001), and between pre-test and post-TM of 3.28 dB (p < .001). The mean difference between post-rest and post-TM was 1.98 dB (p < .001). The findings support the conclusion that Transcendental Meditation increases perceptual acuity, and that the effect of TM is substantially greater than that of ordinary relaxation. Heart rate was also measured and was found to decrease significantly during TM (p < .01), while no significant change was observed during rest.

INTRODUCTION

A number of studies have shown that the practice of the Transcendental Meditation (TM) technique improves perceptual and motor performance, as measured by tests of reaction time (Appelle and Oswald, 1974; Shaw and Kolb, 1977), complex perceptual-motor performance (Blasdell, 1977; Rimol, 1977), and field independence (Pelletier, 1974 and 1977). Pirot (1977) studied the immediate effects of TM on temporal auditory discrimination. Using a group of meditators who acted as their own controls, Pirot demonstrated that performance after the practice of TM was superior to that following relaxation. An earlier pilot study by Graham (in press) had suggested that meditators show lower frequency and amplitude discrimination thresholds in response to auditory stimuli after a period of TM than following a control period of reading a book.

The present study was designed to examine the hypothesis that the level at which an individual will perceive sound stimuli will be of lower amplitude following a period of TM than following a period of rest.

In addition, measurements of heart rate were taken during the rest and meditation periods with a view to clarifying an apparent anomaly raised by Pirot's study: Pirot did not find heart rate and skin resistance to be predictive of differences between meditation and relaxation conditions, and found this 'surprising' in the light of earlier studies demonstrating that TM leads to a unique low arousal hypometabolic state (Allison, 1970; Wallace, 1970; Wallace et al., 1971; Orme-Johnson, 1973).
MATERIALS AND METHODS

DESIGN—Twenty-nine subjects were arbitrarily assigned to one of two groups. One group was instructed to practise Transcendental Meditation in the first phase of the experiment and to rest with eyes open in the second phase (MR). The other group was instructed to rest with eyes open in the first phase and to practise TM in the second phase (RM).

SUBJECTS—Twenty-nine volunteer subjects (15 females and 14 males), all of whom practised TM regularly, took part in the study. Ages ranged from 16 to 61 years, with a mean of 35.8 years. Range of experience of TM varied from 3 months to 10 years, with a mean of 34.6 months. Sex, age, and duration of practice of TM were not counterbalanced between groups.

PROCEDURE—Each subject was individually tested in an anechoic chamber whilst seated comfortably in an easy chair. All subjects were given verbal instructions for the hearing test. All subjects serving in the meditation condition were instructed to meditate with eyes closed for 20 minutes, and all subjects serving in the resting condition were told to relax with eyes open for 20 minutes.

The audiometric threshold test was performed before and after the first phase of the experiment, and a third time after the second phase. A BSA (descending method; Glorig, 1965) pure tone air-conduction (A.C.) threshold test was administered with a Peters type 53200B DD. (serial no. 2000014/43) audiometer with A.O. Safety International headphones (serial no. 112000). The test was performed on each ear separately at 250, 1000, and 4000 Hertz. The subjects indicated whether they had heard the tones by simply saying 'yes'. The threshold of hearing at 1000 Hz was established first; tones were presented as pulses from 0.5 to 2 secs in duration with silent intervals between the tones of 0.5 to 5 secs.

Starting at 40 dB above the International Standards Organisation zero of threshold, the tone was decreased in intensity from audibility to inaudibility at 10 dB intervals until it could be no longer detected. The tone was then increased in intensity in 5 dB steps until the signal was detected again. Once again the tone was decreased in intensity at 5 dB intervals until the sound was inaudible. This increasing and decreasing was continued until three consistent responses were made. The level of these responses was recorded on an audiogram as the threshold at that frequency.

The tests took about five minutes in each case and the subjects were asked to keep their eyes open during each test.

Heart rate recordings were made using a Washington series 400 MD/2 pen recorder rigged as an electrocardiogram using an FC 123 ECG coupler.

The recordings were made with the machine outside the anechoic chamber so the subjects would not be disturbed by the noise of the recording pens. Silver/silver chloride surface electrodes were attached to the palmar surface of each wrist using electrode jelly to ensure good electrical contact. Recordings were made for a two-minute period starting at 5, 10, and 15 minutes into each meditation/rest period. The electrodes were only removed after the final audiometric test to minimize disturbance to the subjects. All subjects were questioned after the test to ensure that they had not suffered any hearing loss in the previous forty-eight hours, and that their heart rate had not been affected by stimulating or quiescent drugs.

RESULTS

HEARING THRESHOLD—Figure 1 shows the mean thresholds for all subjects taken together, combining scores at all frequencies for both ears. Table 1 and figs. 2 and 3 show the mean scores for all subjects at each frequency for the two ears separately, and for both ears taken together. Figure 4 is a time series plot...
of the mean performance of the two groups (RM and MR) at all frequencies for both ears.

Analysis by paired t-test was conducted on the scores of all subjects taken together, in order to assess the significance of the differences between thresholds at pre-test, post-rest, and post-TM. This analysis revealed the following results:

1. **Pre-test vs. Post-rest**—The mean improvement in combined score over all frequencies for both ears (1.29 dB) was highly significant ($N = 29$, $t = 3.60$, $p = .001$). There were no significant differences in threshold between pre-test and post-rest at any of the separate frequencies for the left ear, nor at 250 Hz for the right ear. However, threshold improved significantly for...
the right ear at 1000 Hz (N = 29, \( t = 2.12, p < .05 \)) and at 4000 Hz (N = 29, \( t = 3.49, p < .002 \)).

2. **Pre-test vs. Post-TM**—The mean improvement in combined score over all frequencies for both ears (3.28 dB) was highly significant (N = 29, \( t = 7.55, p < .001 \)). There were significant improvements in threshold for each ear at each frequency: for the right ear at 250 Hz (N = 29, \( t = 3.21, p < .003 \)), at 1000 Hz (N = 29, \( t = 5.27, p < .001 \)), and at 4000 Hz (N = 29, \( t = 4.51, p < .001 \)); for the left ear at 250 Hz (N = 29, \( t = 2.17, p < .04 \)), at 1000 Hz (N = 29, \( t = 4.88, p < .001 \)), and at 4000 Hz (N = 29, \( t = 3.27, p < .003 \)).

3. **Post-rest vs. Post-TM**—The mean difference in combined score over all frequencies for both ears (1.98 dB) was highly significant (N = 29, \( t = 5.28, p < .001 \)). There were also significant differences in threshold between post-rest and post-TM for the left ear at each frequency: at 250 Hz (N = 29, \( t = 3.08, p < .005 \)), at 1000 Hz (N = 29, \( t = 4.53, p < .001 \)), and at 4000 Hz (N = 29, \( t = 3.02, p < .005 \)). For the right ear there were significant differences at 250 Hz (N = 29, \( t = 2.17, p < .04 \)) and 1000 Hz (N = 29, \( t = 2.81, p < .01 \)), and a trend to significance at 4000 Hz (N = 29, \( t = 1.98, p = .057 \)).

**HEART RATE**—Figure 5 shows a time series plot of mean heart rate for the two groups (RM and MR). Analysis by paired t-test of the mean scores for all subjects taken together showed no significant differences between heart rate values during TM and those during rest. However, analysis of variance revealed that there were significant differences between heart rate at 5, 10, and 15 minutes in the TM phase (\( F(2,56) = 5.38, p < .01 \)), but no significant differences between heart rate values at these intervals in the rest phase.

**DISCUSSION**

The central hypothesis investigated by this study was confirmed. The findings clearly lend support to
the conclusion of previous studies that Transcendental Meditation enhances perceptual acuity, and that the effect of TM is superior to that of ordinary relaxation.

The lack of significant differences between the overall mean heart rate values during TM and rest would, at first sight, appear to be consistent with Pirot's observations. However, inspection of the separate mean values of the RM and MR groups (fig. 5) indicates a distinctly different pattern in the behaviour of heart rate during TM as compared to rest. This difference is confirmed by the analysis of variance. Thus, TM was associated with a significant decline in heart rate while a non-significant increase occurred during rest. This finding is consistent with earlier research on physiological changes during Transcendental Meditation (e.g., Wallace et al., 1971).

ACKNOWLEDGMENTS

I wish to thank Dr. Gordon Bancroft for his support and helpful advice throughout the project. I also wish to express my gratitude to the following for their help in this study: Dr. R. A. Roberts and Mr. J. T. Little for their aid in the design of this work; Mr. D. O. Hughes for the use of his laboratory; Dr. J. R. Gillet and M. Fletcher for help with data processing; and Derek Lowe and Diane Davies for their technical assistance.

REFERENCES


