CHANGES IN SKIN RESISTANCE IN SUBJECTS RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE

MICHAEL A. WEST, B.Sc.
University College of Swansea, University of Wales, Swansea, Wales


Skin resistance increases were greater during the Transcendental Meditation technique than during resting with eyes closed, reading, or listening to music, indicating that the TM technique produces a deeper rest than these other forms of relaxation.—EDITORS

The skin resistance of ten subjects was recorded every 20 seconds for four 20-minute periods of resting, reading, listening to music, or practicing the Transcendental Meditation technique. In eight out of the ten cases the highest single value of skin resistance occurred during the period of meditation. The increase in skin resistance was significantly greater during Transcendental Meditation than during reading, resting, or listening to music. The results support Wallace and Benson’s conclusion that distinct physiological changes accompany the practice of Transcendental Meditation.

INTRODUCTION

Wallace, Benson, and Wilson (5) have found physiological changes during the Transcendental Meditation (TM) technique characteristic of a unique state of restful alertness. Several changes in respiration occurred: oxygen consumption, carbon dioxide elimination, respiratory rate, and minute ventilation decreased with no change in respiratory quotient. Arterial blood pH and base excess decreased slightly, and blood lactate also decreased. Skin resistance markedly increased, while systolic, diastolic, and mean arterial blood pressure, arterial $P_{O_2}$ and $P_{CO_2}$, and rectal temperature remained unchanged. The EEG showed an increase in intensity of slow alpha waves and occasional theta-wave activity.

Orme-Johnson (2) studied the influence of the TM program on the stability of the autonomic nervous system. He measured SRR (skin resistance response) habituation to a 100 db, 0.5 sec 3000 Hz tone for eight meditators and eight nonmeditators during the normal waking state and found that meditators habituated in significantly fewer trials than nonmeditators. Seven subjects from each group were also measured on resting levels of spontaneous SRR’s, and meditators had significantly fewer spontaneous SRR’s than nonmeditators, with a correlation coefficient of 0.73 between the number of spontaneous SRR’s and trials to criterion during habituation. In a second study of spontaneous SRR’s, eight nonmeditators who planned to begin the Transcendental Meditation technique in two weeks were compared to a group of six meditators. Again meditators had fewer spontaneous SRR’s than nonmeditators. Repeated measurements over three different sessions showed that meditators consistently had fewer spontaneous SRR’s than nonmeditators. These results suggest that the regular experience of the state of restful alertness produced by the Transcendental Meditation technique reduces resting levels of sympathetic activity.

The purposes of this study were to replicate and extend the findings of dramatic changes in skin resistance observed by Wallace (3) and Wallace and Benson (4) and to provide additional within-subject controls not utilized in previous experiments on Transcendental Meditation and skin resistance. The hypothesis was that if the Transcendental Meditation technique produces a very deep state of rest and relaxation, a period of meditation should be characterized by a higher level of skin resistance than three control periods of resting, book-reading, and listening to music.

METHOD

SUBJECTS—Ten subjects were tested. All were undergraduates at University College, Swansea, and varied in age from 19 to 23 years. All the subjects were taught the Transcendental Meditation technique by qualified teachers. The length of time the subjects had been meditating varied from five months to two years 11 months.
Subsequently, it was learned that Subject 4 had been taking the drug Motival for a week prior to the experiment. As the effects of the drug were probably constant throughout the experiment, the results have been included.

APPARATUS—The subject sat on a comfortable chair in a quiet, congenial room with a constant room temperature of 70 degrees Fahrenheit. The recording apparatus was housed in the same room, but was out of the sight of the subject.

The electrodes were two chlorided silver discs, 10 mm in diameter, with connecting leads plugged into sockets on the back of their soft plastic bases. Before the electrodes were applied to the palmar area, the hands were cleaned with surgical spirit. Sodium chloride electrode jelly was injected through the top of the electrode so that contact between the electrodes and the skin was maintained.

The skin resistance changes were measured with a meter supplied by Electronic Developments Ltd. A constant current of eight microamps dc was passed through the subject via the electrodes. The voltage across the subject’s basal resistance was read from a balancing control. Readings were taken every 20 seconds. A single long-playing record was used for the period in which the subject listened to music. The record used was “Friends” by Elton John (EMI Records Ltd.—SPFL 269). The book used for the reading period was The Wind in the Willows by Kenneth Grahame.

PROCEDURE—Each subject’s skin resistance was measured over four 20-minute periods. The subject was assured that the experiment would be in no way unpleasant and was told the function of the psychogalvanometer so that he would not be unnecessarily apprehensive about the experiment. For the rest period he was instructed to relax with eyes closed, without going to sleep, and to resist any temptation to meditate during this period. For the music period the subject was told to relax and just listen to the music. For the reading period the subject was instructed to read the book until asked to stop. For the meditation period the subjects were asked to meditate as they usually would and were assured that they would not be disturbed until the end of meditation, which was signaled after about 18 minutes. Out of 24 possible presentation orders, ten were chosen by referring to a random numbers table.

RESULTS

Table 1 shows the mean skin resistance of all ten subjects for each period. Of the four periods, six subjects showed the highest mean skin resistance during meditation, two subjects during the music period (Subjects 3 and 9), one subject during the book-reading period (Subject 4), and one subject during the resting period (Subject 5).

The highest single value of skin resistance over all four periods occurred during the meditation phase for eight of the ten meditators (figs. 1–10). Table 2 shows that values of up to 320,000 ohms were found in the TM period, and the figures show that skin resistance generally increased throughout the meditation period. When the subject received the signal to stop meditating, skin resistance dropped dramatically in the space of 80 seconds from the peak it had reached to slightly below the premeditation level. In some instances this was a drop in skin resistance of over 300,000 ohms in that time.

An analysis of variance of the ranges in skin resistance across the four periods produced a significant overall F of 30.35 (p < .001). A post hoc Newman-Keuls test indi-

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>MEAN SKIN RESISTANCE DURING DIFFERENT 20-MINUTE TEST PERIODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBJECT</td>
<td>MEDITATION (kiloohms)</td>
</tr>
<tr>
<td>1</td>
<td>242.4</td>
</tr>
<tr>
<td>2</td>
<td>214.9</td>
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<tr>
<td>3</td>
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<td>4</td>
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<tr>
<td>5</td>
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<td>6</td>
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<tr>
<td>9</td>
<td>128.1</td>
</tr>
<tr>
<td>10</td>
<td>143.9</td>
</tr>
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</table>

Mean         178.38            143.17           160.43            142.83
S.D          44.63             109.22            91.96              76.53

<table>
<thead>
<tr>
<th>TABLE 2</th>
<th>RANGE OF SKIN RESISTANCE DURING DIFFERENT 20-MINUTE TEST PERIODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBJECT</td>
<td>MEDITATION (kiloohms)</td>
</tr>
<tr>
<td>1</td>
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</tr>
<tr>
<td>2</td>
<td>321.0</td>
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<tr>
<td>3</td>
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<td>4</td>
<td>134.3</td>
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<tr>
<td>7</td>
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<td>8</td>
<td>170.7</td>
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<tr>
<td>9</td>
<td>168.1</td>
</tr>
<tr>
<td>10</td>
<td>131.1</td>
</tr>
</tbody>
</table>

Mean         183.92            25.82            36.14             41.38
FIG. 1. SKIN RESISTANCE FOR SUBJECT 1 WHILE RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE

FIG. 2. SKIN RESISTANCE FOR SUBJECT 2 WHILE RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE

FIG. 3. SKIN RESISTANCE FOR SUBJECT 3 WHILE RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE

FIG. 4. SKIN RESISTANCE FOR SUBJECT 4 WHILE RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE
FIG. 5. SKIN RESISTANCE FOR SUBJECT 5 WHILE RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE

FIG. 6. SKIN RESISTANCE FOR SUBJECT 6 WHILE RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE

FIG. 7. SKIN RESISTANCE FOR SUBJECT 7 WHILE RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE

FIG. 8. SKIN RESISTANCE FOR SUBJECT 8 WHILE RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE
cated that the range in the TM group was significantly greater than in any other group (p < .01). The differences in range were not significant among any of the other groups. Skin resistance rose sharply in all ten subjects during TM and then dropped back to the pre-TM level once the meditation was finished (see figs. 1–10). The greater range of skin resistance during TM indicates that skin resistance increases significantly more during TM than during resting, reading, or listening to music.

DISCUSSION

The findings of the experiment may be summarized as follows:

1. The highest mean level of skin resistance was found in the TM period.
2. The lowest mean level of skin resistance was found in the reading period and the resting period.
3. The highest single value of skin resistance occurred during the TM period for eight of the ten subjects.
4. All subjects showed the greatest range in skin resistance during the TM period. The mean range was significantly greater during TM than during any other period, indicating that the TM technique causes a significantly greater increase in skin resistance than reading, listening to music, or resting.
5. There was a sudden and dramatic drop in skin resistance at the end of the meditation period that was characteristic of all subjects.

The difficulties of psychophysiological testing were apparent throughout the experiment. Much was done to alleviate any apprehension the subjects felt—their surroundings were comfortable, and they were assured that the experiment would be quite pleasant. Nevertheless, all the subjects reported difficulty in meditating with the knowledge that they were somehow being tested (except Subject 3). As Gale (1) points out, most of the difficulties involved in psychophysiological testing are as much those of the subject as they are of the experimenter, since the subject does not know what is expected of him and may be valiantly struggling to act "normally." To combat these problems the subjects were allowed an explanation of the measuring instrument, and the testing was performed in the experimenter’s home in as great an effort as possible to prevent feelings of nervousness on the part of the subjects.

The fact that the resting period showed a relatively high overall level of activation might be due to the subjects’ providing their own stimulation in a relatively stimulus-free situation.

These results support the findings of Wallace, Benson, and Wilson (5). Though not entirely conclusive in themselves, they suggest that the Transcendental Meditation technique produces an accelerated change in the basal level of skin resistance. The dramatic drop in skin resistance found in all subjects during the immediate postmeditation period, taken in conjunction with physiological correlates of meditation found in other studies, suggests that a rapid return to the "normal" wakeful

FIG. 9. SKIN RESISTANCE FOR SUBJECT 9 WHILE RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE

FIG. 10. SKIN RESISTANCE FOR SUBJECT 10 WHILE RESTING, READING, LISTENING TO MUSIC, OR PRACTICING THE TRANSCENDENTAL MEDITATION TECHNIQUE
metabolic state occurs in the subject after the experience of restful alertness.

When the changes in skin resistance during the TM technique observed in the present study are compared with changes in skin resistance during sleep observed in other studies, it is found that the rate of increase in skin resistance is much faster and the amount of increase is much larger during Transcendental Meditation than during sleep. Therefore, the results of the present study are consistent with Wallace's suggestion that a unique state of restful alertness is achieved during the practice of the Transcendental Meditation technique.

REFERENCES

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