

# Relaxation Therapy as an Adjunct Treatment for Essential Hypertension

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Essential hypertension is one of the leading problems seen by a family physician, and it is not easily treated. In some instances, a behavioral therapy may serve as a useful adjunct to the pharmacological treatment of this disease. Evidence indicates that relaxation therapy in combination with medical treatment results in significantly greater reductions in systolic and diastolic blood pressure than the use of medical treatment alone. Progressive muscle relaxation, Benson's "relaxation response," hypnosis, and blood pressure biofeedback are the four most common behavioral treatments for essential hypertension. The first two of these are both effective and well suited to use in a family practice.

Hypertension is one of the leading problems seen by a family physician and is one that is not easily treated. A great percentage of people presenting with this disease are young adults and the middle-aged, so that institution of pharmacological therapy usually commits them to 30 to 40 years of uninterrupted therapy. In a population that otherwise looks and feels healthy, compliance is less than optimal, and the emergence of side effects will only aggravate it.<sup>1</sup>

There is increasing evidence that stress is implicated in the development of essential hypertension.<sup>2</sup> The co-variation between stressful life events and elevated blood pressure has been repeatedly observed.<sup>3-5</sup> Kasl and Cobb,<sup>6</sup> for instance, found increased blood pressure levels in factory workers who proceeded through the stages of hearing rumors of a plant shutdown to actually experiencing long-term unemployment. Epidemiological studies additionally support the view

that environmental stress contributes to the development and/or maintenance of hypertension.<sup>7,8</sup>

## Behavioral Control of Essential Hypertension

While most family physicians are well versed in pharmacological means of controlling hypertension, they are not as familiar with the behavioral techniques available to treat this disease. A variety of related techniques have been used to achieve blood pressure control in hypertensive patients. They include progressive muscle relaxation,<sup>9-15</sup> Transcendental Meditation,<sup>16-18</sup> Buddhist meditation,<sup>19</sup> Benson's "relaxation response,"<sup>20,21</sup> galvanic skin response biofeedback with yogic breathing,<sup>22,23</sup> hypnosis,<sup>13,24-26</sup> blood pressure biofeedback,<sup>27-33</sup> and instructions alone to lower blood pressure.<sup>34</sup> For the purposes of this article the authors have grouped the treatments under four general headings: (1) those that concentrate explicitly upon the subject's elicitation of deep muscle relaxation as a means of lowering blood pressure, (2) techniques that produce a meditative state, characterized by a reduced respiratory rate, (3) hypnotherapeutic approaches, and (4) investigations that rely solely upon biofeedback instrumentation with instructions to lower blood pressure.

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## Progressive Muscle Relaxation

As early as 1920 Edmund Jacobson, the author of progressive muscle relaxation, noted that several of his hypertensive patients "characteristically held various skeletal muscles in a somewhat rigid or over-contracted manner."<sup>9</sup> Jacobson believed that this muscle rigidity directly contributed to the abnormally elevated blood pressure and that with muscle relaxation, blood pressure would return to normal levels. He presented data on four hypertensives who, within the session, obtained average systolic and diastolic reductions of 13 and 11.3 mmHg, respectively, after only 45 minutes of relaxation therapy. Two recent case studies have reported findings almost identical to Jacobson's, though 40 years later.<sup>10,11</sup>

### Treatment Description

Progressive muscle relaxation is easily learned by the patient and does not require any technical apparatus. The initial stage of treatment involves the patient's becoming aware of the difference between feelings of tension and relaxation. This is accomplished by first tensing individual muscle groups and then allowing the muscles to become as limp as possible. Exercises begin by studying the tension in the right hand which occurs when the hand is balled into a fist for 5 seconds. The hand is then relaxed for 10 to 15 seconds, after which the subject is instructed to tense the left hand in a similar manner. The patient is usually taught to tense and relax 16 individual muscle groups. After repeated practice the patient is able to dispense with the tensing aspect of the program and instead concentrate solely on relaxing the muscles. An excellent transcript of progressive relaxation therapy has been provided by Lazarus,<sup>35</sup> and audio cassettes are widely available.

### Controlled Treatment Studies

Several controlled treatment studies of the effects of progressive muscle relaxation have been conducted.<sup>12-15</sup> Brauer et al<sup>14</sup> and Taylor et al<sup>15</sup> who had the most methodologically sound studies, both found that progressive muscle relaxa-

tion used in combination with pharmacological therapy, produced significantly greater blood pressure reductions than either standard medical treatment alone or medical treatment in combination with psychotherapy. Average blood pressure reductions of 18 mmHg systolic and 10 mmHg diastolic were recorded in the Brauer et al study at six months post-treatment.

### Medication Confound

In these last two studies, as in most of those to be considered in this review, at least 50 percent of the patients were taking hypotensive medications. Reduced blood pressure could thus be attributed to the effects of medication or to an interaction between the medical and behavioral treatments. In the two studies reviewed, sign tests were used to determine if differences existed between groups in terms of changes in the patients' medication dosages. There were no differences in either study, thus suggesting that the medication changes were not associated with the differential responses of the groups. While the blood pressure declines witnessed in these two studies may have resulted from the interaction of medical and behavioral treatments, relaxation procedures have been found sufficient to reduce blood pressure levels in unmedicated hypertensive patients.<sup>10,11,14,18</sup>

### Meditation/Relaxation Response

The majority of studies on the voluntary control of blood pressure have involved the achievement of a meditational state which is characterized by slow, regulated breathing in the presence of a passive mental attitude. Wallace, Benson, and Wilson<sup>36</sup> pioneered this area with their examination of the physiological changes that occur during the practice of Transcendental Meditation (TM). The 14 normotensive subjects who participated in the first study showed significant declines in oxygen consumption, carbon dioxide elimination, respiratory rate, and blood lactate levels.

### Group Case Studies

Herbert Benson and his colleagues have successfully employed Transcendental Meditation in the treatment of mild essential hypertension.<sup>16,17</sup> In one investigation, 22 hypertensive patients (average systolic and diastolic blood pressures = 149.5/94.6 mmHg) were instructed in Transcendental Meditation after a six-week baseline of blood pressure recording. Subjects were asked to practice meditation on their own, twice a day for 20 minutes at a time.<sup>16</sup>

After 25 weeks, systolic blood pressure had declined an average of 7 mmHg, with a diastolic reduction of 3.9 mmHg. These declines could not be attributed to the effect of medication since none of the subjects were receiving pharmacological therapy. Similar results were obtained by Blackwell et al<sup>18</sup> and Stone and DeLeo.<sup>19</sup> In this latter study, 14 subjects who practiced a form of Buddhist meditation for six months achieved average systolic and diastolic blood pressure declines of 14.8 and 10.1 mmHg, respectively. A group of five non-randomly selected control subjects showed no changes in blood pressure.

### The Relaxation Response

Benson has demonstrated that the physiological changes which occur during the practice of Transcendental Meditation can be elicited by several related relaxation techniques.<sup>20</sup> He has summarized and simplified these techniques in the form of the "relaxation response." The relaxation response is achieved by simply observing the following instructions:

1. Sit quietly in a comfortable position.
2. Close your eyes.
3. Deeply relax all of your muscles, beginning at your feet and progressing up to your face (just let muscles go limp).
4. Breathe through your nose. Become aware of your breathing. As you breathe out, say the word "one" silently to yourself.
5. Continue for 20 minutes. When you finish just sit quietly for a few minutes.
6. Do not worry about whether you are successful at attaining a deep level of relaxation. Maintain a passive attitude and permit relaxation to occur at its own pace. When distracting

thoughts occur, ignore them and continue repeating "one."

7. Practice these exercises twice daily.

### Controlled Treatment Study

Support for the efficacy of the relaxation response is provided by a controlled study in which 126 normotensive patients were randomly assigned to one of three conditions: (1) relaxation response, (2) a sit quiet and relax group, and (3) a no treatment group.<sup>21</sup> After four weeks of baseline recording, subjects engaged in 12 weeks of practice. At post-treatment, mean systolic and diastolic blood pressure declines for the relaxation response group (6.7/5.2 mmHg) were both found to be significantly greater than those for the relaxation control (2.6/2.0 mmHg) and no treatment control groups (.5/1.2 mmHg). Subjects in both the relaxation response and relaxation control groups showed improved physical and psychological health, as measured by several self-report inventories.

### Meditation with GSR Feedback

Chandra Patel, one of the first investigators in this field, has combined several treatment components in working with hypertensive patients.<sup>22,23</sup> Patients are instructed in yogic breathing and passive relaxation, similar to the relaxation response, and are told that they can give themselves suggestions for bodily relaxation, similar to hypnosis. Subjects are also given occasional galvanic skin response feedback to assist them in their efforts to relax.

### Randomized Control

In a preliminary uncontrolled study, 20 hypertensive patients were seen individually three times per week for 12 weeks.<sup>22</sup> At post-treatment they had achieved average systolic and diastolic declines of 26 and 16 mmHg, respectively. These



findings were replicated in a subsequent investigation in which 35 subjects were randomly assigned to a treatment group (as described above) or a nonspecific relaxation control group (subjects in this latter group were instructed to recline on a couch and to relax themselves).<sup>23</sup> Subjects in each group were seen twice weekly over a six-week period. At post-treatment, treated subjects showed significantly greater systolic and diastolic declines than subjects in the control group (average decrease of 27/16 mmHg for treated subjects as opposed to 8/5 mmHg for controls).

### Hypnotic Treatment

Several investigators have employed hypnosis in the treatment of essential hypertension.<sup>13,24-26</sup> This approach customarily begins with a hypnotic induction which is designed to elicit a deep, bodily relaxation through suggestions of arm and leg heaviness and the like.<sup>37</sup> The therapist may proceed to describe relaxation eliciting scenes<sup>38</sup> and to give direct suggestions to relax internal organs including the heart, blood vessels, and arteries.<sup>13</sup>

At present it is difficult to draw sound conclusions concerning the effectiveness of hypnosis as a treatment for essential hypertension. Deabler and his colleagues<sup>13</sup> and Friedman and Taub<sup>24</sup> have reported blood pressure reductions approximately equal to those achieved by progressive muscle relaxation and meditation. However, these successful outcomes are contradicted by reports of no effect for hypnosis<sup>25</sup> and by findings that a hypnotic induction actually produced small but significant within-session rises in both systolic and diastolic blood pressure among both hypertensive and normotensive patients.<sup>26</sup> These studies, taken as a whole, additionally have methodological shortcomings which include: (1) a lack of adequate baseline measurements prior to beginning treatment, (2) the absence of random assignment of patients to treatment groups, (3) and the failure to include adequate attention-control conditions. Thus, controlled studies are needed to determine both the effectiveness and active treatment com-

ponents of the hypnotic control for essential hypertension.

### Biofeedback Treatment

The two principal biofeedback methods that have been used in controlling essential hypertension are blood pressure feedback and electromyogram (EMG) feedback. In the former procedure, a standard blood pressure cuff is placed around the upper arm and inflated to a fixed pressure, where it is maintained for about 30 seconds. A microphone is placed over the brachial artery at the distal edge of the cuff, thus allowing for detection of Korotkoff sounds (KS). The cuff pressure is said to equal the average systolic or diastolic blood pressure when 50 percent or more of the subject's heart beats are accompanied by the Korotkoff sounds. When Korotkoff sounds are heard 25 percent of the time or less, blood pressure is said to have changed by 2 mmHg. Subjects are thus made aware of changes in their blood pressure on the basis of the feedback provided, though they must customarily determine the means by which to actually lower their arterial pressure.

In electromyogram feedback the subject is provided information as to whether he has successfully reduced muscle tension in any number of bodily sites. Recordings are made usually from the frontalis muscle (forehead). Given the purported relationship between muscle tension and blood pressure,<sup>9</sup> investigators have hypothesized that blood pressure reductions would accompany decreases in frontalis muscle tension.

### Controlled Treatment Studies

Although early case studies<sup>27,28</sup> and a controlled outcome study<sup>29</sup> found blood pressure feedback to produce significant blood pressure reductions, recent studies have raised questions concerning the long-term effectiveness of biofeedback techniques and concerning the complexity and expense of the

procedures as compared to simpler relaxation methods.<sup>30-33</sup> With the exception of Frankel et al,<sup>31</sup> these studies compared the efficacy of biofeedback techniques to relaxation/meditation approaches in controlling hypertension. There were no statistically significant differences between groups, with relaxation methods actually showing a slight superiority during some stages of treatment.

### Physiological and Behavioral Mechanisms

While the evidence indicates that subjects are able to voluntarily lower their blood pressures, questions still remain concerning which physiological and behavioral mechanisms are responsible for the observed changes. Most non-diuretic, anti-hypertensive drugs reduce blood pressure by interfering with the production or reception of noradrenalin. In very simplified terms, sympathetic arousal is decreased, leading to vasodilation and, thus, to lower arterial pressure.<sup>39</sup>

Relaxation/meditation therapy is thought to work in a similar manner but by a different avenue. Proceeding from the work of Hess,<sup>40</sup> Benson contends that the "relaxation response" elicits an integrated hypothalamic response which results in decreased sympathetic nervous system activity.<sup>2</sup> The response is mediated by the parasympathetic nervous system and originates in the area of the anterior hypothalamus. Hess found that electrical stimulation of this area in the cat resulted in decreases in muscle tension, blood pressure, respiratory rate, and pupil constriction. He contends that: "We are actually dealing with a protective mechanism against overstress belonging to the trophotropic-endophy-lactic system and promoting restorative processes."

### Behavioral Mechanisms

Benson may well have described the physiological processes which lead to decreased blood pressure. The problem can then be studied from the vantage point of which treatment components, of those reviewed, are necessary and/or sufficient to elicit blood pressure reduction. While Jacobson<sup>9</sup>

hypothesized that blood pressure reduction was caused by a decrease in muscle tension, this thesis was not supported by Goldman and Lee's<sup>41</sup> findings. Subjects who were successful in reducing muscle tension (EMG feedback from frontalis muscle) did not achieve an accompanying decline in blood pressure, leading the authors to conclude that: "muscle activity, thus, cannot be considered a potent mediator of blood pressure change." Unfortunately, this study is not sufficient to settle this question since several investigators do not believe that frontalis EMG feedback produces a "generalized relaxation."<sup>42,43</sup>

### Decreased Respiratory Rate

Progressive muscle relaxation, as opposed to EMG induced relaxation, has been found to result in significant decreases in respiratory rate,<sup>44</sup> as has Transcendental Meditation.<sup>36,44</sup> Decreased respiratory rate has been found, in turn, to be a mediator of blood pressure reduction.<sup>41</sup> Thus, progressive muscle relaxation may elicit blood pressure reductions in a similar manner to the relaxation response, by serving as a vehicle for the reduction of respiratory rate.

### Instructions Alone

Redmond et al<sup>34</sup> believe that instructions alone may be a sufficient condition for blood pressure reduction. Their subjects were able to significantly raise systolic blood pressure (but not diastolic) and significantly reduce both systolic and diastolic pressure on the basis of verbal instructions alone (average SBP and DBP reduction of 10 and 5 mmHg, respectively). However, Williamson and Blanchard,<sup>45</sup> in reviewing six studies on biofeedback and blood pressure, conclude that instructions alone are not sufficient to elicit significant blood pressure reductions.

### Beyond Placebo Effects

In the absence of understanding the specific physiological and behavioral mechanisms in-

volved in the behavioral treatment of essential hypertension, some clinicians may wonder whether the relaxation therapies merely produce placebo effects. The definition and determination of what constitutes a placebo effect is a very complex issue that arises not only with behavioral treatments but in many other therapeutic situations in everyday practice (see Kirsch,<sup>46</sup> for a discussion). However, the Patel and North,<sup>23</sup> the Peters et al,<sup>21</sup> and to a lesser degree, the Brauer et al<sup>14</sup> and Taylor et al<sup>15</sup> studies provide ample evidence that the observed blood pressure reductions are a specific consequence of relaxation/meditation therapy rather than the result of nonspecific (placebo) treatment factors or habituation to the laboratory conditions. Further support for this claim is provided by the fact that when the control subjects in the Patel and North study were instructed in meditation practice at the study's conclusion, they achieved blood pressure reductions equivalent to the originally treated group.

### Applicability to a Family Practice

If family physicians are to use a behavioral therapy in the treatment of essential hypertension, they must believe that the treatment can be provided (1) in the context of a busy office practice, (2) by a physician without any special knowledge or expertise in the relaxation exercises, (3) for patients of average intelligence and socioeconomic status. A recent study by Hahn,<sup>47</sup> conducted at a rural family practice center near Iowa City, Iowa, found affirmative answers to these three issues. Three quarters of these rural Iowans (total = 34) who were approached expressed interest in a behavioral treatment of hypertension which was taught to them during a routine office visit. Hahn had no formal training in the relaxation response or other related techniques. Approximately one half of Hahn's patients achieved moderate blood pressure reductions (average of 11.7/8.8 mmHg) as a result of participating in the program.

### Patient Selection

At present, virtually no research has been conducted to identify what sorts of patients are most likely to benefit from a behavioral treatment for essential hypertension. Patel<sup>48</sup> has anecdotally reported a sex difference, with 90 percent of female patients responding to treatment vs 66 percent of male patients. It would not be surprising to find that personality, lifestyle, and physiologic factors are important in this realm.

As with the pharmacological treatment of hypertension, the family physician will most likely obtain the best results with motivated, well-informed patients who will adhere to the behavioral treatment program. Patients hoping to reduce their medication dosage in order to eliminate the severity of a side effect would potentially be well motivated. Previous findings suggest that treatment results should be evident within the first one to three weeks if the patient is practicing the exercises.

### Treatment Selection

The present evidence indicates that relaxation/meditation techniques are more desirable than the biofeedback methods because relaxation therapy (1) has been shown to be consistently effective in reducing hypertension, (2) is inexpensive and easily learned, (3) requires no laboratory instrumentation (the absence of which would prevent home practice), and (4) promotes greater patient involvement with treatment. Additionally, regular relaxation practice may improve the individual's psychological and physical health.<sup>21,49,50</sup> While hypnosis shares some of relaxation therapy's practical advantages over the biofeedback treatments, the hypnotic treatment of essential hypertension lacks empirical support, and the physician may have to obtain special training to use this treatment method.

### Treatment Generalization

Some clinicians may ask the question whether treatment effects (reduced blood pressure) pro-



duced in the laboratory or office will generalize to the patient's home environment or place of work. Several investigators have used different settings for training and assessment and have found blood pressure declines in the assessment setting (at home or in a second physician's office).<sup>11,15,16,18</sup> Thus, evidence does suggest that treatment effects do generalize to environments other than the treatment setting.

### *Maintenance of Treatment Effects*

A fourth and very important issue concerns the maintenance of treatment effects. Continued practice of the relaxation exercises appears to be necessary to maintain decreased blood pressure levels since several studies have shown pressures to return gradually toward baseline levels after active treatment was concluded.<sup>10,18,30,33,51</sup> While difficult, the task of achieving treatment maintenance is not insurmountable, as Patel<sup>52</sup> has reported therapeutic effects to be sustained one year after treatment. Patel attributes this favorable outcome to helping the patient to incorporate the relaxation exercises into his daily living schedule. After the individual becomes skilled in the techniques, relaxation can be practiced for a couple of minutes at a time, for instance, during morning coffee breaks or while riding the bus home from work.

Ensuring the patient's compliance with a pharmacological or behavioral regimen is a difficult task. While the physician's efforts to educate and support the patient may contribute to this end, they will probably not be sufficient in all cases.<sup>53</sup> Recent evidence suggests that treatment adherence will be improved if the physician reviews the patient's daily living schedule with him and then makes specific suggestions concerning when and where the patient should take his medication or practice his behavioral therapy.<sup>54</sup> Secondly, the patient's family members, known to the provider in a family medicine center, can be enlisted to facilitate the patient's treatment adherence.<sup>55</sup> The patient's spouse, for instance, should be helped to understand the physical and psychological effects of the patient's illness, but perhaps more importantly, the spouse should be given specific in-

structions concerning how to improve the patient's treatment adherence. This method has been successfully employed in the treatments of obesity<sup>56,57</sup> and alcoholism<sup>58,59</sup> (to which the reader is referred for suggestions, particularly the Brownell et al<sup>56</sup> study).

### *Relaxation as an Adjunct Treatment*

As has been seen, a number of studies have reported large, clinically significant blood pressure reductions achieved through the use of a behavioral treatment in combination with pharmacotherapy, or in some cases, through the use of a behavioral therapy alone. Many patients in the former category achieved such large and stable reductions that their medications were reduced, or in some cases, eliminated entirely. Despite these encouraging results, it is recommended that behavioral therapies be used only in an adjunct capacity, in the treatment of established hypertension, until more conclusive findings are available.

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