TREATMENT OF INSOMNIA IN CANCER PATIENTS USING MUSCLE RELAXATION TRAINING

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Previous research suggested that sleep onset insomnia was significantly reduced with the use of relaxation techniques; however, the majority of these studies used college student populations with mild to moderate insomnia. The objective of the present study was to assess the effectiveness of using muscle relaxation training in a clinical population knwon to have sleeping difficulties--cancer patients.

A sample of 30 subjects (11 men and 19 women) aged 21 to 80 were on the self-report criteria of an inability to fall asleep within 30 minutes, and a diagnosis of cancer for which they were receiving medical attention. Subjects in the study had various types of cancer. About one-half of the subjects experienced pain of moderate intensity due to their medical condition and about one-third were taking analgesics. Expected longevity for the patients was 3½ years. The 30 subjects reported having insomnia for a mean of 10 years and took about 1½ hours to fall asleep.

Subjects were randomly assigned to either the muscle relaxation treatment or routine care group. Each subject monitored sleep behavior for a 9-day period completing a Daily Sleep Questionnaire and the State-Trait Anxiety Inventory. The

Daily Sleep Questionnaire assessed sleep behavior including minutes to fall asleep, total hours of sleep, number of times awakened during the nights, intrusive thoughts, tension, and pain experienced at bedtime, satisfaction with sleep, and the degree of restedness felt in the morning. The State-Trait Anxiety Inventory assessed the emotional state of the subjects and was intended to measure any positive or untoward side effects of monitoring sleep behavior or learning muscle relaxation training. Treatment subjects monitored their sleep behavior 3 days before treatment began, throughout the 3-day treatment process and for 3 days following treatment. The routine care group simply monitored their sleep behavior for a 9-day period.

Each subject in the treatment group received 3 training sessions from the same experimenter in a quiet location. Training sessions included the use of standardized instructions teaching progressive muscle relaxation.

All data were recorded and scored according to standard procedures. Mean changes in sleep-onset time were for the muscle relaxation group 124 minutes to 29 minutes, for the routine care group 116 minutes to 109 minutes. A discriminant function analysis showed that sleep onset latency was the only dependent measure on the Daily Sleep Questionnaire to significantly discriminate between the two groups ($p < .01$). The analysis of the data from the State-Trait Anxiety Inventory using discriminant function analysis revealed no systematic positive or negative side effects of either monitoring of

sleep behavior or of learning the muscle relaxation training.

Results of this study suggest that muscle relaxation training is an effective technique to reduce sleep onset insomnia in cancer patients, and perhaps also in any clinical group. The technique seems especially promising since it was shown to be effective with severe insomniacs suffering severe medical problems. Results of the study were discussed in terms of possible explanations for the efficacy of the treatment, potential uses of the technique with other clinical populations, and ease of teaching nonpsychologist health professionals to treat with muscle relaxation training.

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TREATMENT OF INSOMNIA IN CANCER PATIENTS USING MUSCLE RELAXATION TRAINING

The world of the cancer patient is fraught with problems. For the terminally ill patient, there are the burdens of bearing the body's degeneration, and facing the prospect of death with, somtimes without, the concern of family and friends. Less dramatic, perhaps, but no less serious are the patients who have hope for sustained life through treatment. The treatments can be quite debilating: radiation therapy upsets the entire body chemistry, chemotherapy saps the body of its ability to fight infection, radical or procedural surgery always results in some painful recuperation. The physical effects of cancer treatments have been widely documented. Recently, the psychological impact of having cancer has captured the concern of the medical profession (Holland, 1973).

Successful treatment procedures always require commitment from the cancer patient, commitment to bear the prolonged idscomfort and side effects of the treatment process. The effects of such prolonged and debilitating treatments on the quality of the patient's life is therefore a source of much interest (Holland, 1977a).

One of the common psychological problems of the cancer patient and particularly for pain patients is that of insomnia (Holland, 1977b; Kales, Kales, & Humphrey, 1975; Kinard, 1977; Mathis, 1978; Saunders, 1976). Insomnia

unfavorably influences the quality of life not only during the time of its occurrence, but it also frequently produces fatigue and irritability during the subsequent day (Saunders, 1976). Such fatigue and irritability exacerbate the strain on interfamilial and interpersonal relationships that a diagnosis of treatable, yet incurable, cancer produces.

No one can deny that cancer patients, indeed any seriously ill person, should have supportive therapy, even if it is merely palliative. Supportive drugs, when available, are often less than the optimal treatment because of their side effects or deterimental effects of chronic use; with the problem of insomnia, the use of hypnotic drugs is often contraindicated on both of these grounds. Since psychological interventions have rarely been shown to have adverse side effects or chronic effects in people with normal personalities, a psychological treatment for insomnia in cancer patients seemed to be a worthwhile goal.

While not specifically in the cancer population, researchers have recently turned their attention to the diagnosis and treatment of sleep disorders.

Sleep Disorders

Coates and Thoresen (1978) estimated that 15-20 million Americans suffer chronically from insomnia. One definition of insomnia recently offered was "the complaint of sleep loss" (Regestein & Reich, 1978). A commonly used classification of insomnia was that provided by Kleitman (1963). He described three types of insomnia according to the time of occurrence.

The latency or sleep onset insomnia was characterized by the inability to initially fall asleep. The second type, interrupted sleep, was characterized by frequent awakenings during the night. The third type, terminal insomnia, was characterized by early morning awakening often at an intolerable hour. Almost all of the experimental research has been on latency insomnia (Borkovec, 1977). While studies vary in the criteria used, all have a latency time of at least 30 minutes to identify mild insomnia and 50 minutes to identify severe insomnia. Another distinction has also been made in classifying insomnia. Primary insomnia was used to refer to sleep loss in the absence of other symptomatology or obvious environmental stress. Secondary insomnia referred to disturbed sleep from patients with clear psychological or environmental problems.

A number of surveys attempted to estimate the extent of insomnia within normal populations. Although each had methodological problems, these studies provided an overall idea of the prevalence of insomnia. A study done in Melbourne, Australia, found that 7.4% of the sample reported suffering from moderate or severe insomnia and an additional 16% complained of mild insomnia (Krupinski & Stoller, 1971). Luce and Segal (1969) reported the rate of insomnia in the United States to be 14% for people in general and 18 to 19% for females. Raybin and Detre (1969) conducted a survey among first-year nursing and medical students. They found rates of insomnia of 33% for the nursing students, 13% for the medical students and 20% for the combined sample. All of the nursing students

were female and the overwhelming majority of the medical students were male. Borkovec and Fowles (1973) surveyed a large introductory psychology class in the Midwest and found that 12% felt they had a sleeping problem.

The demographic and personality characteristics of insomniacs has been another area of research. McGhie and Russell (1962) conducted a survey of two cities in Scotland. They found that insomnia was more prevalent with females, older people, and lower socioeconomic groups. Luce and Segal (1969) found a consistent correlation between insomnia and the trait of anxiousness. Monroe (1967) used a sleep questionnaire and EEG recordings in a sleep lab to identify groups of good and poor sleepers. On the MMPI, the poor sleepers had significantly higher scores on 9 of the 13 scales. They also showed greater psychosomatic and emotional disturbance on the Cornell Medical Index. Monroe also found an increased heart rate, peripheral vasoconstriction, and rectal temperature during sleep for the poor sleepers, compared with good sleepers. This finding suggests that poor sleepers have a higher level of psychological arousal during sleep and that the sleep of insomniacs is different not only in quantity, but also in quality from that of normal persons.

Coursey, Buchsbaum, and Frankel (1975) studied a group of chronic primary insomniacs and matched control group. Both self-report and EEG measures were employed to select the control group.

Insomniacs were found to be more depressed, anxious, and hypochondriacal than the control subjects and to worry more. Marks and Monroe (1976) attempted to differentiate adolescent poor sleepers from other emotionally disturbed adolescents. They found the adolescent poor sleepers evidenced similar personality characteristics as did the adult poor sleepers in Monroe's (1967) study. Monroe also found that about 20% of the emotionally disturbed adolescnets had sleep problems and 13% of their sample had been referred because of sleep problems. Males were referred more frequently than females for sleep problems. Chronic insomniacs were found to be complaining, over-sensitive people. In two separate studies, 85% of the 274 subjects were found to have at least one elevation on the MMPI with the depression scale being the most common (Kales & Kales, 1972; Kales et al., 1975; Rother & Kramer, 1975). In summary, the research to date suggests most primary insomniacs are anxious people who are likely to demonstrate elevations on the MMPI. In addition, they show physiological differences from normals during the sleeping process.

The more medically oriented porfessionals generally associate insomnia with psychiatric disorders. For example, Kales, Kales, and Humphrey (1975) contended that the majority of patients with chronic or severe insomnia fell within the diagnostic category of the neuroses or personality disorders, and have a history of chronic anxiety associated with depression. Early psychiatric profiles were primarily dominated by psychoanalytic formulations. For example, Fenichel (1945)

says of insomnia that "the cathexis of repressed wished . . . make sleep impossible. Also acute worries or affect laden expectations, whether agreeable or disagreeable, particularly sexual excitement without gratification, make for sleeplessness. In the case of neurotic disturbances of sleep, the unconscious factors of course outweigh the others" (p. 189). A more recent formulation from a psychiatric perspective was that provided by Kales and associates (1975) who suggested that insomniac patients often had difficulty in expressing or controlling their aggressive feelings. Going to sleep was viewed by patients as a loss of control, whereas the insomnia represented a defense against this fear. The treatment of choice from a psychiatric viewpoint for insomnia was seen to be psychotherapy with efforts directed at the underlying cause for the symptom of insomnia (Kales et al., 1975; Redlich, Freedman, 1966).

Pharmacological treatments are seen to have an important place in the treatment of many insomniacs both by psychiatrists and by physicians in general. The use of drugs was seen as an adjunct in the treatment of chronic insomnia, or for the use in transient insomnia resulting from situational disturbances, or in medical conditions (Kales et al., 1975).

The most frequent approach used by the general physician is pharamacological. About 27 million prescriptions were written for hypnotics in 1976 (Coates & Thoresen, 1978). Barbiturates, accounting for 20% of these prescriptions, lead to a predictable cycle of dependence, tolerance, and escalating

doses. These medications also have been found to disrupt the sleep structure. Rapid eye movement (REM) and slow wave sleep stages 3 and 4 were supressed, and the EEG showed increased beta activity. Physical and psychological dependence and withdrawal reactions (severe nightmares and sleep more disturbed than before taking the medication) often accompanied attempts to stop taking these drugs.

Nonbarbiturate hypnotics (e.g., methaqualone, meprobamate, chloral hydrate, and glutelthizide which cannot for 33% of the hypnotics prescribed) have been shown to affect sleep in ways similar to the barbiturates (Coates & Thoresen, 1978). Body movements, number of arousals, and latency to sleep onset were decreased while total sleep time was increased. However, the nonbarbiturates decrease total REM and slow wave sleep and increase EEG beta activity. Similarly, they lead to dependence and tolerance. Marked reactions and REM rebound have been found to accompany withdrawal of these drugs.

The benzodiazepines are presently the drug of choice. They have been shown less likely to produce negative side effects, but complications still arise. Generally, agreement has been shown that the chroi-nc use of hypnotics worsen sleep with more awakening periods occurring (Regestein & Reich, 1978). Collins (1912) warned, "Insomnia cannot be cured by drugs" (p. 105) and Burce (1915) stated, "Any treatment of insomnia which places its main reliance in the use of drugs is foredoomed to failure" (p. 178).

The cancer patient falls into the category of secondary insomnia. Clearly cancer poses environmental and psychological stresses with subsequent psychological consequences. The routine treatment of medical patients with insomnia has been pharmacological. However, since the use of this approach has the potentially serious side effects of disrupting the sleep cycle, drug dependence, unwanted mood changes, and producing withdrawal symptoms (Hartman, 1972; Oswald & Priest, 1965), other modes for treating insomnia have been sought.

Psychological Treatments

Over the past 10 years there has been increasing interest in developing nonpharmacological behavioral treatments which might promise better benefits. These approaches have included muscle relaxation training, systematic desensitization, biofeedback, hypnosis, and autogenic training.

Patients have varied in terms of their reports of bedtime tension and cognitive activity. Most patients reported excessive cognitive intrusions (e.g., "racing mind," worrying about past or future events) that they could not turn off. In addition, some patients reported excessive nervousness, tension, or other autonomic arousal (Borkovec, 1977). The treatment methods listed below address one or both of these contributing factors.

Hypnosis

One of the earliest psychological treatment procedures was hypnosis, which induced relaxation and often utilized posthypnotic suggestion and self-hypnosis (Hanley, 1965).

Fry (1963) reported success in the alleviation of insomnia by hypnotic suggestion. Borkovec and Fowles (1973) found hypnotic induction equally as effective as muscle relaxation and both superior to no-treatment control procedures. The successful use of hypnosis has also been reported in anecdotal case studies by Tiller (1967) and Todd and Kelly (1970). Graham, Wright, Toman, and Mark (1975) compared the effectiveness of using muscle relaxation versus hypnotic procedures. Using a subjective rating scale, subjects in both the hypnotic and relaxation conditions reported substantial improvement in their sleep problems following training, but objective records showed only subjects in the relaxation condition achieved a significant reduction in the incidence of insomnia. Overall, there have been only a few controlled studies in hypnosis and its effectiveness in treating insomnia has yet to be demonstrated.

Autogenic Training

Another relaxation procedure, called autogenic training, was developed by Schultz and Luthe (1959) to induce relaxation. The subjects repeat suggestions of warmth and heaviness to themselves over and over again. Evidence was presented that suggestions of heaviness induce muscle relaxation. The authors presented case studies in which this training successfully altered insomnia. Kahn, Baker, and Weiss (1968) evaluated the use of autogenic training with 16 college student insomniacs. According to the subjects' verbal report, treatment resulted in significant reduction in time to fall asleep; however,

there was no control group. Nicassio and Bootzin (1974) found the use of autogenic training equally as effective as using progressive relaxation and both were superior to control. In summary, the research on autogenic training is too limited to make an evaluation of its effectiveness. However, it does appear to be a promising technique.

Biofeedback

A recent development has been in applying the use of biofeedback to insomnia. Biofeedback procedures were utilized to bring about a state of relaxation in the subject. Raskin, Johnson, and Rendestendt (1973) provided six subjects suffering from insomnia with EMG frontalis muscle feedback. Subjects received EMG feedback until they could maintain a low muscle tension criterion for 25 minutes. Five of the six subjects reported dramatic improvement. Budzynski (1973) found significant improvement in a group of insomniac patients using both EMG and EEG alpha feedback. Two studies comparing the relative efficacy of biofeedback EMG relaxation training with other approaches have been done (Freedman, 1975; Haynes, Sides, & Lockwood, 1977). Both studies found EMG feedback superior to placebo or no-treatment control, and no less effective than relaxation training. Too few studies have been done with EMG to substantiate its effectiveness but it too appears to be a promising technique.

Systematic Desensitization

Relaxation training has been used as a component in systematic desensitization in the treatment of insomnia.

Many studies have successfully employed systematic desensitization with one item instead of a hierarchy. Geer and Katkin (1966) originated the single item procedure. The item attempted to focus the subject's attention on unsettling thoughts at bedtime. Their original work was a case study. Self-report indicated that the insomnia was markedly alleviated after 14 therapy sessions.

In a second care report, Evans and Bond (1969) found single item desensitization to the cognition of attempting to fall asleep ineffective in treating a patient's insomnia. However, in four experimental studies success was achieved using the single fear item (Borkovec, Steinmark, & Nau, 1973; Gershman & Clouser, 1974; Ribordy, 1975; Steinmark & Borkovec, 1974). For example, Borkovec, Steinmark, and Nau (1973) used 24 sleep disturbed subjects who were assigned to one of three therapy conditions: relaxation alone, desensitization and relaxation, and desensitization without relaxation. After three sessions, significant improvement occurred in reported latency of sleep onset, rated difficulty in falling asleep, and number of awakenings during the night. There was no significant difference between the three conditions. It appears systematic desensitization is a viable technique in reducing insomnia.

Muscle Relaxation Training

The most commonly used psychological technique in the treatment of insomnia is that of muscle relaxation. By far, the most studies have investigated this approach and found

Substantial evidence to suggest that relaxation training was an effective technique in treating insomnia (Borkovec, 1977). The first systematic use of muscle relaxation in the control of insomnia was reported by Jacobson (1938). Jacobson developed techniques involving the systematic tensing and relaxing of the muscle groups aimed at achieving low levels of tension at will. His technique also had the subject focus attention on teh resultant feelings of tension when the muscles are tensed and the feelings of relaxation that occur when muscles are released. A popular modification of the Jacobson technique, and one utilized freuqently in research, has been that provided by Bernstein and Borkovec (1973). Their relaxation training involved the demonstration by the therapist of the 16 muscle groups to be employed during training, with instructions of obtaining tension and release in each group. Once the subject understood the procedures they carried on the techniques on their own. Some of the studies have employed a passive relaxation technique in which the tensing of the muscle groups was eliminated. Simple instructions to relax the various muscle groups were employed. Numerous experimental studies have been conducted, many employing placebo control or no-treatment control groups (Kahn et al., 1968; Paul, 1969; Hinkle & Lutker, 1972, Borkovec & Fowles, 1973; Borkovec et al., 1973; Weil & Goldfried, 1973; French & Tupin, 1974; Gershman & Clouser, 1974; Steinmark & Borkovec, 1974; Ribordy, 1975; Nicassio & Bootzin, 1974; Haynes. Woodward, Moran, & Alexander, 1974;

Graham et al., 1975; Borkovec, Kaloupek, & Slama, 1975; Borkovec & Weerts, 1976; Haynes et al., 1977; Mitchell & White, 1977). All of the above studies were successful in employing relaxation training to reduce latency onset insomnia. Many of the studies compared the effectiveness of one approach such as autogenic training with that of muscle relaxation.

The subjects in most of these studies were college students and did not appear to be representative of a true clinical population. According to their latency times they would most likely be classified as mild insomniacs, if they presented as patients at all. A few exceptions to this included the studies of Lick and Heffler (1977) and Mitchell and White (1977), in which subjects in the study were severe primary insomniacs (sleep latency greater than 50 minutes). As Cooper, Furst, and Bridges (1969) pointed out, most controlled outcome research has employed subjects displaying analogue "problems" of questionable relevance to distressed clinical populations.

Although treatment of mild insomnia among college populations is certainly a worthwhile goal, many clinicians and physicians may wonder whether these techniques are as effecatious on various clinical populations. The purpose of the present study was to assess the effectiveness of muscle relaxation, one of the more substantiated approaches, for the treatment of insomnia in a clinical population of cancer patients.

Method

Subjects

Included in the subject pool were patients who had been diagnosed as having cancer and who were being followed by medical personnel for this condition. Subjects were in- and outpatients at the Medical University of South Carolina. Only adults 16 years or older were utilized. Subjects were referred for this study by the attending or resident physicians who were responsible for treatment of these oncology patients. The physicians were instructed to choose cancer patients who were discovered to have sleep onset insomnia of at least 30 minutes duration and desired treatment for it. In addition to physician referrals the experimenter solicited additional subjects for the study by attending various medical facilities at the Medical University Hospital. Subjects were recruited at the Radiation Therapy Center, Cancer Clinic, Private Diagnostic Clinic, and among inpatients on the hospital wards. Patients were asked if they had difficulty falling asleep and desired treatment for this condition.

Subjects were interviewed to obtain the following information: (a) basic demographic data, (b) duration of insomnia and estimated amount of time to sleep onset, and (c) parameters of pain, if any, that they were experiencing (see Appendix A). These procedures obtained 30 subjects. They were randomly assigned to one of two groups--muscle relaxation or routine care group.

Self-report Measures of Sleep Behavior

Follwoing the initial interview, subjects monitored their sleep behaviors by completing a Daily Sleep Questionnaire (see Appendix B) pertaining to their sleep behavior the previous night and completed the State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970) pertainint to how they felt that morning. The Anxiety Inventory questionnaire was used in order to assess the effect of self-monitoring and treatment on the emotional state of the subjects. Self-report measures of sleep onset latency, although sensitive to response bias and experimental demand factors, have been shown to covary with physiological measures of sleep onset latency (Monroe, 1967) and estimates of selep onset latencies by outside observers (Nicassio & Bootzin, 1974).

Subjects were instructed to monitor their sleep behavior consecutively for 9 days. Treatment subjects monitored their sleep behavior 3 days before treatment began, throughout the 3-day treatment process and for 3 days following treatment. The routine care group simply monitored their sleep behavior and filled out the Anxiety Inventory for a 9-day period.

Treatment Procedures

For the subjects in the muscle relaxation group, the initial period of the first session was devoted to rationale presentation and treatment procedure description. The remainder of Session 1 and throughout Sessions 2 and 3 consisted of muscle relaxation training as seen in Appendix C (Bernstein &

Borkovec, 1973). All treatment subjects received muscle relaxation training individually from the same experimenter. Training procedures were carried out in various locations that were convenient for the subjects. These included a quiet office at the Medical University Hospital, the patient's home, or in the patient's hospital room. Treatment subjects were given a sheet containing instructions for home practice of the relaxation training (see Appendix D).

The Anxiety Inventory and Daily Sleep Questionnaires were picked up daily for those subjects who were inpatients or who regularly visited the Medical University Hospital. For the other subjects, uqestionnaires were either mailed to the experimenter or picked up by him at the end of the 9-day period.

Results

The results are presented in sections. First, the results pertaining to the differences between the muscle relaxation and routine care treatment groups on the initial interview data, then the results on the reported effects of the treatment, and finally the results on the State-Trait Anxiety Inventory are presented.

Initial Interview

A description of the sample by demographic data is presented in Table 1. The distribution of sex, race, religion, marital status, number of children and educational training are all remarkably similar. The one category of some note is age. The treatment group mean age is 53.2 years while the

Table 1

Distribution of Subject Characteristics by Groups

Characteristic	Treatment Group	Routine Care Group	Combined
Sex			
Male	6	5	11
Female	9	10	19
Age, mean	53.2	58.4	55.8
Range	21-74	22-80	21-80
Race			
White	10	11	21
Black	5	4	9
Religion			
Baptist	7	7	14
Methodist	5	7	12
Other	1	1	2
None	2	0	2
Marital Status			
Married	8	10	18
Separated	2	2	4
Divorced	1	0	1
Widowed	2	2	4
Single	2	1	3
Number of Children ($\bar{X}$)	4.4	4.4	4.2
Education			
Less than 6th grade	3	3	6
More than 6th grade less than H.S.	5	7	12
More than 11th grade	7	5	12

routine care group is 58.4 years. However, age ranges for the two groups are very similar. The range for the treatment group is 21 to 74 years; while the range for the routine care group is 22 to 80 years.

Table 2 presents subject characteristics relating to the patient's medical condition. There is some variation in relation to cancer type. The treatment group contained four subjects with breast cancer or sarcoma while the routine care group contained no cancer types of this variety. Although there is a large difference between the two groups on how long their cancer had been diagnosed (treatment $\bar{X}$ = 4.8 years; routine care $\bar{X}$ = 8.0 years), this is not a significant contributor to discriminating between the two groups. Although not presented in the table, the large standard deviation of 7.84 for this variable appears to negate the meaning of the difference. The sources of the subjects are also similar with the majority, 13 in each group being outpatients. Both the treatment and routine care group contained two inpatients. The majority of outpatients for both groups came from the Cancer Clinic and the remainder of the outpatient samples were receiving services at the Radiation Therapy Department or at the Private Diagnostic Clinic. Both groups have equal numbers receiving radiation or who were postsurgical patients. Approximately equal numbers received chemotherapy. The treatment group had more patients who were presurgical, while the routine care group has more follow-up patients. Expected

Table 2

Subject Characteristics Relating to Medical Condition

Characteristic	Treatment Group	Routine Care Group	Combined
Cancer Type			
Genito-urinary	6	6	12
Gastrointestinal	2	3	5
Respiratory	1	2	3
Lymphomas and Leukemias	1	2	3
Sarcomas and Breast	4	0	4
Skin and other	1	2	3
How long cancer diagnosed ($\bar{X}$ years)	4.8	8.0	6.4
Subject source			
Cancer Clinic	7	10	17
Radiation Therapy Department	4	3	7
Private Diagnostic Clinic	2	0	2
Hospital Inpatient	2	2	4
Procedures Presently Receiving			
Radiation	3	3	6
Chemotherapy	6	5	6
Presurgery	3	1	4
Postsurgery	1	1	2
Follow-up	2	5	12
Expected Longevity	3 years, 3 months	4 years, 6 months	3 years, 10 months

longevity for groups were about the same. It is interesting to note that for the combined groups, the physicians' prediction was that their life expectancy was less than 4 years.

Table 3 presents subject characteristics relating to pain. In the treatment group, 10 subjects reported experiencing pain while only 6 did in the routine care group. However,

Table 3

Subject Characteristics Relating to Pain

Characteristic	Treatment Group	Routine Care Group	Combined
Experience Pain?			
Yes	10	6	16
No	5	9	14
M.D.'s Estimate of Pain ($\bar{X}$; 1 = None, 5 = Severe)	2.3	1.8	2.1
Patient's Estimate of Pain ($\bar{X}$; 1 = None, 5 = Severe)	3.3	1.8	2.5
Patient's Estimate of Pain at Worst ($\bar{X}$; 1 = None, 5 = Severe)	3.7	1.8	2.7
Hours of Pain	12.6	5.0	8.8
Take Pain Medication?			
Yes	7	4	11
No	8	11	19
How Much Does Medication Help? ($\bar{X}$; 1 = Has no effect, 5 = Removes pain entirely	3.4	3.6	3.5

these differences are nonsignificant as tested by Fishers Exact Test. The mean amount of pain is moderate for both groups. Treatment subjects reported experiencing more pain than did the routine care group. The physician's estimate of their patients gain is less than that reported by the patients themselves. Also treatment subjects reported longer hours of pain.

Table 4 presents subjects' characteristics relating to insomnia at the time of the initial interview. The only variable of note among this group is years of insomnia. The treatment groups average is 4.2 years, while the routine care group average is 15.7 years. However, this does not contribute to a significant discrimination between the two groups.

Based upon a discriminant function analysis on the interview data, five variables significantly contribute to the discrimination between the treatment and routine care groups (see Table 5). These variables are how much pain they ordinarily experienced, how much pain they experienced at its worst, whether or not patients were presurgical, used analgesics, and how well-rested they were on awakening each morning.

These results suggest the differences between the groups existing before treatment began. The routine care group rate as being more rested in general after a nights sleep than the treatment group. The routine care group mean on this item is 3.0 (rested) as opposed to the treatment group mean of 2.4 (unrested to rested). This difference suggests

Table 4

Mean Subject Characteristics Relating to Insomnia at Initial Interview

Characteristic	Treatment Group	Routine Care Group	Combined
Years had insomnia	4.2	15.7	9.9
Minutes to fall asleep	106.7	94.3	100.5
Hours of sleep	5.1	6.2	5.6
Times awake during night	3.3	2.8	3.0
How tense feel as go to sleep? (1 = no tension, 5 = very tense)	3.5	3.5	3.5
Experience disturbing thoughts as try to sleep (1 = none, 5 = many)	2.9	2.8	2.9
Experience pain as try to sleep (1 = none, 5 = very severe)	2.7	1.8	2.3
Difficulty falling asleep (1 = none, 5 = a great deal)	4.0	3.5	3.8
How satisfied with your sleep (1 = very unsatisfied, 5 = very satisfied)	2.2	2.6	2.4
How rested are you after sleeping (1 = very unrested, 5 = very rested)	2.4	3.0	2.7

the treatment group may have been more motivated to improve, since they in general felt more unrested after a night's sleep. However, since the routine care group had no need for motivation to work on treatment, this does not seem important.

Table 5

Significant Discriminators from Initial Interview

Item	Treatment Group Mean	Routine Care Group	F	Wilks' Lambda	Significance
Pain at worst (1 = none, 5 = severe)	3.67	1.80	10.20	.733	.001
Use analgesic (1 = yes, 2 = no)	1.53	1.73	5.27	.613	.01
How well rested (1 = very unrested, 5 = very rested)	2.37	3.07	5.90	.499	.0001
Presurgery Patient (1 = presurgery patient, 0 = nonpresurgery patient)	.30	.07	5.22	.444	.0001
Ordinary amount of pain (1 = none, 5 = severe)	2.33	1.83	5.81	.374	.0001

Moreover, one can consider this pointing to a more serious insomnia prior to treatment in the treatment group.

The second variable that significantly contributes to differentiating between the two groups was whether the subject was taking an analgesic or not. Seven treatment subjects were taking one as opposed to four in the routine care group. The relevance to treatment outcome of this fact is questionable. One might speculate that the pain medication may make it easier to fall asleep. However, the groups do not differ in

difficulty in falling asleep as rated by themselves at the time of the initial interview, nor in time it took to fall asleep. Therefore, although the treatment group contains more subjects who took analgesics, this does not seemingly affect the ease or difficulty of falling asleep, although one cannot rule out an analgesic by treatment interaction effect.

Similarly, identification of subjects as presurgical patients significantly contributed to distinguishing between treatment and routine care groups. The porportion of presurgical patients is .20 in the treatment group and .07 in the routine care group. This difference does not seem to represent a meaningful advantage for the treatment group.

The two variables that do seem to be of some clinical significance are amount of pain that the patient was experiencing and the amount of pain experienced at its worst. Means for pain at its worst are 3.67 (moderate to severe) for the treatment group and 1.80 (none to mild) for the routine care group. Means for ordinary amount of pain are 2.33 (mild to moderate) for the treatment group and 1.83 (none to mild) for the routine care group. These data highlight the fact that patients in the treatment group were experiencing more pain both ordinarily and when the pain became most severe. This would appear to have made it more difficult for the treatment group to achieve success. Or conversely, if the treatment procedure was effective, it would have to be so despite the fact that the treatment group was working

against greater odds, namely the greater amount of pain that they were experiencing.

Daily Sleep Questionnaire

On the Daily Sleep Questionnaire there are 10 questions that the subjects answered each morning about their sleep the previous night. The questionnaires were answered daily, before, during and after treatment for a 9-day period for the treatment subjects and similarly by the routine care group. These 10 questions constituted the primary outcome measures for this study. To prevent inappropriate deflation of the actual significance level a discriminant function analysis was used rather than multiple separate tests of significance. Of the 10 variables on the Daily Sleep Questionnaire only one variable significantly contributes to the discrimination between the two groups; it is the amount of time it took the subject to fall asleep. Table 6 contains the four means on this variable and other summary statistics.

These results show dramatic reduction in the amount of time it took treatment subjects to fall asleep after receiving the muscle relaxation training. This reduction was in contrast to the routine care group whose sleep latency times remained about the same.

The other nine variables (hours of sleep, number of awakenings, tenseness, racing thoughts, amount of pain, time of taking pain medication, difficulty in falling asleep, sleep satisfaction, and restfulness) do not contribute to discriminating

Table 6

Means and Sumamry Statistics for
Sleep Onset Latency

Eigenvalue	Canonical Correlation	Wilk's Lambda	Chi-Square	df	p
1.38	.76	.42	23.36	2	.006

Statistic	First 3 Days	Last 3 Days
Treatment Group ($\bar{X}$; in minutes)	124	29
Routine Care Group ($\bar{X}$; in minutes)	116	109
df	2,27	1,28
F	12.78	17.12
Wilk's Lambda	0.42	0.62
Significance Level	0.0001	0.0001

between groups independent of sleep onset latency. The means for these variables are contained in Table 7.

State-Trait Anxiety Inventory

A discriminant function analysis was done on the State-Trait Anxiety Inventory in order to assess any advantageous or untoward side effects attributable to the intervention. The analysis was performed on change scores on each of the 20 items comparing the first 3 days with the last 3 days for both groups (by subtracting the latter from the former). Results of the analysis found 5 of the 20 items significantly

Table 7

Daily Sleep Questionnaire Items 2-10[a]

Item	Treatment Group		Routine Care Group	
	First 3 Days	Last 3 Days	First 3 Days	Last 3 Days
Hours of Sleep ($\bar{X}$)	4.98	6.53	6.28	6.51
Times Awakened ($\bar{X}$)	3.37	1.80	2.95	2.93
Tenseness as Went to Bed ($\bar{X}$; 1 = very relaxed, 5 = very tense)	3.28	2.74	3.19	3.18
Racing Thoughts as Went to Bed ($\bar{X}$; 1 = none, 5 = a great deal)	2.69	2.18	2.48	2.33
Pain Experienced as Went to Bed ($\bar{X}$; 1 = none, 5 = a great deal)	2.66	2.22	2.24	2.22
Pain Medication				
Yes	8	8	5	6
No	7	7	10	9
Difficulty in Going to Sleep ($\bar{X}$; 1 = very easy, 5 = very difficult)	3.74	2.62	3.17	3.20
Satisfaction with Sleep ($\bar{X}$; 1 = very unsatisfied 5 = very satisfied)	2.33	2.98	2.88	2.93
Restedness on Awakening ($\bar{X}$; 1 = very unrested 5 = very rested)	2.51	3.32	3.05	3.13

[a]None of these items significantly contributed to the differentiation between the two groups.

contributed to differentiating between the two groups (no difference was found for the change scores based upon the total anxiety scores). These items were "I am regretful," "I feel nervous," "I feel high strung," "I feel joyful," and "I feel pleasant." Table 8 presents summary statistics for these items.

Table 8

Significant Discriminators from the State-Trait Anxiety Inventory

Item	Treatment Group Mean	Routine Care Group Mean	F	Wilk's Lambda	p
I feel joyful	.09	-.24	3.29	.89	.07
I feel nervous	.15	-.18	8.51	.68	.00
I am regretful	-.16	-.20	4.52	.58	.01
I feel pleasant	.00	.04	4.96	.48	.00
I feel "high strung"	-.18	.02	3.13	.72	.01

The treatment group rated themselves as being more "high strung" during the last 3 days. Both groups rated themselves as being more regretful during the last 3 days; however, the routine care group was even more regretful. At the end of the 9-day period, the routine care group rated themselves as being more joyful, but less pleasant. Finally, during the last 3 days the treatment group felt less nervous while the routine care group felt more nervous.

While these changes have low significance levels, they do not appear to reflect any meaningful positive or negative side effects of either the monitoring of sleep behavior or of performing muscle relaxation training. The mean absolute change for these five items over both groups was only .13 (.12 for the treatment, .14 for the routine care). This amount of change and all of the individual changes are trivial when construed in an applied manner.

Discussion

The present study was deisgned to gather information on the therapeutic benefit of using relaxation training in treating the insomnia of clinical cancer patients. Of primary concern was testing the probability that this technique might have efficacy in alleviating sleep onset insomnia in an actual population of patients. The ability to reduce insomnia for persons experiencing pain was of secondary interest.

The significant effect for the muscle relaxation group on the dependent measure of sleep onset latency indicates that the subject's self-reported insomnia was significantly improved. However, since a true placebo control group was not included in the design, the significant reduction in sleep onset latency in the muscle relaxation group could have been due to demand characteristics. On the other hand, the daily self-monitoring of sleep behavior may in some sense be considered a partial placebo control. Although the credibility of the placebo would probably have been low, the daily data

recording by these patients and the contacts with the experimenter did represent an intrusion into their lives which might have been expected to suggest improvement.

Other studies on insomnia have achieved mixed results when employing a placebo treatment condition. One found that the inclusion of the placebo control group similarily achieved reduction in sleep onset insomnia (Steinmark & Borkovec, 1974), while others have found no improvement with placebo relaxation training (Freedman, 1975; Nicassio & Bootzin, 1974). The mixed results with the use of a placebo treatment may be explained by differences in teh credibility of the placebo (Bootzin & Nicassio, 1978). Therefore, it remains unclear what exactly may be the curative ingredient of the muscle relaxation technique. Demand Characteristics may not be ruled out as contributing to the efficacy of this approach; however, the art of healing has had, and continues to have, an important role for effective placebo treatment, thus in many ways this argument is moot.

What is the critical element that effected the positive results in reducing sleep onset latency? One possible explanation already discussed was demand characteristics. Two other factors that have been suggested in previous research and which were addressed in the present study were excessive cognitive intrusions and autonomic arousal (Borkovec, 1977). In the present study, subjects monitored nightly the amount of thoughts on their mind and the amount of tension or nervousness that they felt. Neither of these factors showed significant

differences in distinguishing the treatment and routine care group. Therefore, neither self-reported arousal reduction nor reduced cognitive activity were seen by the subjects as possible explanations of sleep improvement. However, arousal reduction as a possible cause of change cannot be ruled out since only self-reported arousal was measured and no physiological correlates were taken.

Davidson, Tsukimoko, and Glaros (1973), in their study of attribution effects of improvement in falling asleep, believed that a feeling of increased self-control contributed to subjects' improvement. This could have been an active ingredient in the present study. Expectancy of improvement coupled with a credible procedure could be the insomnia-reducing factor.

Another possible explanation for the positive results of this study may have to do with the fact that the subjects were cancer patients. A majority of these subjects were experiencing pain of moderate intensity. It is possible that the muscle relaxation technique produced distraction from the patient's pain so that they could fall asleep more easily. Pain distraction is a common technique currently being used in pain management programs (Borkovec, 1977; Fordyce, 1976). Alternatively, the muscle relaxation technique may have affected the pain directly by loosening tightened muscle groups that were producing the pain itself.

Finally, another possible explanation for the reduction in the sleep onset latency is that, with the use of muscle

relaxation training, the bed was the stimulus for relaxation and sleeping. Many insomniacs make bedtime an occasion to rehash the days events and to worry about the next day. If this happens regularly, the bed may become a cue for worrying rather than a cue for sleeping. Through repeated trials of relaxation training in bed, it is possible that these responses were altered, making the bed and bedtime a cue for relaxing and going to sleep.

The only variable on the Daily Sleep Questionnaire to achieve a reportable significance level was reduction in time to fall asleep. The fact that no systematic effect on reported hours of sleep, number of nightly awakenings, sleep satisfaction, or how well the subject felt rested was detected is noteworthy. Other studies investigating these same variables have achieved mixed results. The majority have not achieved positive changes in these variables, while others have (Borkovec & Fowles; Borkovec et al., 1975; Haynes, et al., 1977). These results would seem to indicated that the technique of muscle relaxation is effective in treating sleep onset latency, but not necessarily these other problems. Ancetedotal reports from subjects in the present study suggest that the technique does seem to reduce time to return to sleep after waking during the night.

The fact that the relaxation technique only effects sleep onset is not surprising if one considers that it is a voluntary cognitively controlled behavior. Once the subject successfully

falls asleep, the conscious control of relaxation is lost. Thus, under this construction, one would not expect longer sleep, fewer awakenings, or quality of sleep to be effected.

The primary thrust of the present study was to investigate the use of a method of reducing insomnia developing in nonmedical, mild insomnia populations on a clinical population of cancer patients. Since positive results were demonstrated, the question may be asked: To what extent are these procedures of clinical use in terms both of amount of improvement and of ease of employing the procedure?

The muscle relaxation group reduced the time to fall asleep from a mean of 126 minutes at pretreatment to 29 at posttreatment. Six subjects reduced their sleep onset latency to less than 15 minutes, and 90% of treated subjects showed noticeable improvement. This kind of improvement seems clinically significant. However, the two inpatients were two of the three subjects in the treatment group not showing imporvement. This suggests that this technique may not be as useful for inpatients. Due to the small number of inpatients no reliable generalization about this should be made wihtout further research. It may be that the inpatients in the present study were at a crisis point with their disease, and were unable to concentrate on performing the relaxation training.

The ease of employing these procedures has been documented (Borkovec, 1977) and step-by-step manuals for health

care professionals for using muscle relaxation are in existence (Bernstein & Borkovec, 1973). In addition, using aduio-tape instructions on muscle relaxation appears to be similarly effective in producing the relaxed state (Gershman & Clouser, 1974; Lick & Hefler, 1977). The treatment technique is readily learnable by nonpsychologists in continuing education workshops at conventions.

These considerations suggest that the use of relaxation training with cancer patients and other seriously ill populations could be relatively easy, inexpensive, and nontime-consuming proceudre. It would appear this procedure can contribute towards improving the quality of life for patients. The present study found no systematic detrimental side effects to practicing and using muscle relaxation as measured on the State-Trait Inventory.

The use of muscle relaxing training in treatment insomnia has the advantage of avoiding the side effects that hypnotic drugs produce. Since patients tend to develop tolerance, they have a limited duration of usefulness. Muscle relaxation would seem better as an initial therapy, since it has been found to continue to be effective in follow-up studies 1 year after the last treatment (Borkovec et al., 1975). The use of drugs may be saved for the most serious of temporary problems with insomnia. Muscle relaxation treatment also has the advantage of appelaing to those persons who are against the use of drugs for various philosophical or physical reasons. Many

of the subjects in the present study were of this type. They stated, for example, that they did not "believe in drugs" or had tried them in the past and were found ineffective.

Future research may investigate the potentiating effect of relaxation training on the use of hypnotic drugs. Relaxation training may possibly potentiate the effectiveness of hypnotics and may provide the most potent treatment package available in serious cases of insomnia.

Appendix A

Initial Interview

Name:	Address:
Age:	Phone:
Race:	Marital Status:
Education:	Number of Children:
Religion (Active or Inactive)	Occupation:
Physician:	Reason for Admission:
Type of Cancer:	How Long Had Cancer

Procedures to be Undergone:

Physician's estimate of amount of pain

5	4	3	2	1
Very Severe	Severe	Moderate	A Little	No Pain

0. Do you experience pain due to your cancer?

1. How many hours of the day do you experience pain? _____

2. Does the pain come and go, or is it constant once it begins?_____

3. How severe is the pain--on the average? (X) At its worst? (*)

5	4	3	2	1
Very Severe	Severe	Moderate	A Little	No Pain

4. Do you receive pain medication?

5. How does it affect the pain?

5	4	3	2	1
Takes it away Completely	Substantially Reduces pain	Moderately Reduces the pain	Reduces pain slightly	Does not effect the pain

6. How often do you take the medications?

7. What kind do you take?

8. How long have you had difficulty falling asleep?

9. How long on the average does it take you to fall asleep (in minutes)? _____

10. Estimate the average number of hours and minutes of sleep that you get _____

11. Estimate the average number of times you awake during the night _____

12. How tense (in your body) are you just before going to sleep?

5	4	3	2	1
Very Tense	Tense	Neither tense	Relaxed	Very Relaxed

13. How much do you experience disturbing or racing thoughts as you try to go to sleep?

5	4	3	2	1
A great deal	Many	Some	A few	None at all

14. How much pain on the average do you have as you try to go to sleep?

5	4	3	2	1
A great deal	Many	Some	A few	None at all

15. Generally how difficult is it for you to go to sleep?

5	4	3	2	1
A great deal	Many	Some	A few	None at all

16. How satisfied with your sleep are you?

5	4	3	2	1
A great deal	Many	Some	A few	Not at all

17. How well rested are you upon awakening each morning?

5	4	3	2	1
A great deal	Many	Some	A few	Not at all

Appendix B

Daily Sleep Questionnaire

Today's Date: _____

Your Name: _____

The following questions refer to your sleep behavior last night

1. Estimate the number of minutes or hours and minutes that it took you to fall asleep _____

2. Estimate the total number of hours and minutes that you slept _____

3. Estimate the number of times you woke up _____

4. How tense (in your body) were you just before going to sleep? (Place an X)

5	4	3	2	1
Very tense	Tense	Neither tense nor relaxed	Relaxed	Very relaxed

5. How much did you experience disturbing or racing thoughts as you tried to go to sleep?

5	4	3	2	1
Very tense	Tense	Neither tense nor relaxed	Relaxed	Very relaxed

6. How much pain did you have as you tried to go to sleep?

5	4	3	2	1
A great deal	Much	A moderate amount	A small amount	No pain

7. At what time did you take pain medication before going to bed? _____

8. How difficult was it for you to go to sleep?

5	4	3	2	1
Very difficult	Difficult	Neither difficult nor easy	Easy	Very Easy

9. How satisfied with your sleep were you?

5	4	3	2	1
Very satisfied	Pretty well satisfied	Satisfied	Unsatisfied	Very Unsatisfied

10. How well rested were you on awaking?

5	4	3	2	1
Very rested	Pretty well rested	Rested	Not well rested	Very unrested

Appendix C

Content Outline for Relaxation Presentation After Bernstein and Borkovec (1973)

I. Introduction

A. The procedures to be used are called muscle relaxation training.

B. Muscle relaxation training consists of learning to tense and release various muscle groups throughout the body.

C. An essential part of learning how to relax involves learning to pay close attention to the feelings of tension and relaxation in your body.

D. Learning relaxation skills is like learning other motor skills. (I will not be doing anything to you; you will simply be learning a technique).

E. We employ tension in order to ultimately produce relaxation.

1. Strong tension is noticeable and you will learn to attend to these feelings.

2. The initial production of tension gives us some "momentum" so that when we release the tension deep relaxation is the result.

F. Questions and comments.

II. Tensing Instructions

A. We will be dealing with sixteen muscle groups which are tensed and released.

B. Tensing Instructions for Arms and Hands

1. Instructions for right hand and lower arm (make a tight fist).

2. Instructions for right biceps (push elbow down against chair).

3. Instructions for left hand and lower arm.

4. Instructions for left biceps.

C. Tensing Instructions for Face and Neck (model face-making to put client at ease).

1. Instructions for forehead (lift eyebrows as high as possible).

2. Instructions for central section (squint and wrinkle nose).

3. Instructions for lower face and jaw (bite hard and pull back corners of mouth).

4. Instructions for neck (pull chin toward chest and keep it from touching chest).

D. Tensing Instructions for Chest and Abdomen

1. Instructions for chest, shoulders, and upper back (pull shoulder blades together).

2. Instructions for abdomen (make stomach hard)

E. Tensing Instructions for Legs and Feet

1. Instructions for right thigh (strech leg pushing toes down).

2. Instructions for right calf (pull toes toward head).

3. Instructions for right foot (point and curl toes, turning foot inward).

4. Instructions for left upper leg.

5. Instructions for left calf.

6. Instructions for left foot.

F. Questions and comments (be sure alternative tensing strategies are determined where needed)

III. Additional Instructions

A. Various muscle groups are going to be compared with one another in terms of depth of relaxation.

B. Release tension immediately upon cue rather than gradually.

C. Once a group of muscles is relaxed, do not move it unnecessarily (except to make yourself comfortable).

D. Do not talk to me during this session.

E. Notification of length of session and invitation to visit rest room.

F. Removal of constraining items such as watches, rings, eyeglasses, contact lenses, and shoes.

G. Questions and comments.

H. Client reclines in chair.

I. Explanation of dimming of lights.

IV. Relaxation Proper

A. Tense and relax all 16 muscle groups.

B. Hold tension for five seconds in each muscle group, releasing suddenly.

C. Focus on relaxation for 20-30 seconds. Repeat the word relax.

D. Use relaxation patter.

Relaxation Patter

The material which follows is suggested for use after the therapist has said the word "Relax." Do not attempt to use all of these statements after each tension-release cycle, since this would violate timing rules. Rather, a sampling of them in nearly any combination may be employed after any given cycle such that the therapist's behavior does not become routine and predictable.

" . . . and relax, letting all the tension go, focusing on these muscles as they just relax completely, noticing what it feels like as the muscles become more and more relaxed, focusing all your attention on the feelings associated with relaxation flowing into these muscles; just enjoying the pleasant feelings of relaxation, as the muscles go on relaxing more and more deeply, more and more completely. There's nothing for you to do but focus your attention on the very pleasant feelings of relaxation flowing into this area. Just noticing what it's like as the muscles become more and more deeply relaxed; just enjoying the feelings in the muscles as they loosen up, smooth out, unwind, and relax more and more deeply. Just experiencing the sensations of deep, complete relaxation flowing into these muscles; more and more deeply and completely relaxed. Just letting them go, thinking about nothing but the very pleasant feelings of relaxation. Just let those muscles go and notice how they feel now as compared to before. Notice how those muscles feel when so completely relaxed. Pay attention only to the sensations of relaxation as the relaxation process takes place. Calm, peaceful, and relaxed."

Appendix D

Instructions for Relaxation Practice

1. Practice twice a day. Once just before going to sleep.
2. Tense the muscles 3/4's of the way. Don't try to tense them as hard as you dan.
3. Hold the tension for five seconds in the muscle groups, release suddenly and focus on the relaxation for 20-30 seconds.
4. Tense and relax each muscle group twice.

Sixteen Muscle Groups

Look at the list of muscle groups before or after you practice. During the relaxation training your eyes should be closed. If you forget a few of the muscle groups that is OK.

1. Right Hand and Forearm--make a fist
2. Right Biceps--push elbows down
3. Left Hand and Forearm--make a fist
4. Left Biceps--push elbows down
5. Forehead--lift eyebrows as high as possible
6. Upper Cheeks and Nose--squint and wrinkle nose
7. Lower Cheeks and Jaws--bite hard and pull back corners of mouth
8. Neck and Throat--pull chin toward chest but keep it from touching the chest
9. Chest and Shoulders and Back--pull shoulder blades back
10. Stomach Region--make stomach hard
11. Right Thigh--stretch leg pushing toes downward
12. Right Calf--pull toes toward head
13. Right Foot--point and curl toes, turning foot inward

14. Left Thigh--stretch leg pushing toes downward

15. Left Calf--Pull toes toward head

16. Left Foot--point and curl toes, turning foot inward

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