TREATMENT OF ACNE VULGARIS BY
BIOFEEDBACK-ASSISTED CUE-CONTROLLED RELAXATION
AND GUIDED COGNITIVE IMAGERY

DISSERTATION

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By

Barry W. Brown, M. A.

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A cognitive-behavioral adjunctive intervention involving biofeedback-assisted relaxation and cognitive imagery procedures for the treatment of acne vulgaris was investigated in this study with 30 patients, already receiving traditional dermatological treatment, as participants. A three-group design was used which consisted of a treatment (relaxation-imagery), a rational behavior group therapy attention-comparison, and a medical intervention control (medication and lesion extraction) group. The treatment and attention-comparison group subjects were administered the Sixteen Personality Factor Questionnaire at pre- and posttreatment in order to explore personality changes as a function of the psychological intervention that they received. These subjects also engaged in daily home practice procedures in addition to their laboratory treatment sessions. Both these groups received an identical number of laboratory and home practice sessions, and similar experimenter-induced expectations and demand characteristics during treatment. None of the hypothesized therapeutic components of the treatment
group were present in the attention-comparison group. The treatment and attention-comparison group subjects received the same medical intervention as the third group of acne patients who were routinely monitored to control for dermatological treatment effects.

As hypothesized, the treatment group showed a significant reduction in acne severity as compared to the attention-comparison and the medical control group. A second hypothesis, which held that the attention-comparison and control group conditions would not significantly differ from each other was also confirmed. The hypothesis which held that treatment group subjects would exhibit equally low electromyographic biofeedback levels while engaging in either cue-controlled relaxation or guided cognitive imagery was also supported. Significant changes were found across treatment on each of the four second-order personality factors assessed. Data regarding subjects' self-grading of acne severity, expectations for treatment effectiveness, and frequency of home practice was obtained and analyzed for treatment and attention-comparison group subjects.

The results of this research provided strong support for the efficacy of biofeedback-assisted relaxation-imagery therapy as an adjunctive treatment for patients with chronic acne vulgaris. Future research was suggested.
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Acne vulgaris is one of the most common diseases that affects mankind. However, like the "common cold," its etiology is not yet completely understood and no effective treatment exists to remediate the condition. Current attempts to treat acne are aimed at controlling the condition, until it burns itself out, so that scarring can be minimized (Mysliborski & Lumpkin, 1977). To date, society has delegated the treatment of acne to dermatologists. The intent of this author is to demonstrate that acne severity can be reduced by psychological treatment. Such a finding should merit strong consideration, on the part of dermatologists, to involve a psychologist in their treatment of acne patients.

**Definition of Acne**

Acne vulgaris is a self-limited disease involving the pilosebaceous unit of the skin; namely, the sebaceous gland and hair follicle. It occurs primarily in adolescence, but on occasion it will continue into adulthood. Clinically, acne vulgaris can be divided into three major types: non-inflammatory lesions, comedones (blackheads) and milia (whiteheads), are characteristic of mild forms of acne.
Inflammatory lesions (papules, pustules, nodules, cysts, and abscesses) develop from the noninflammatory types, and are characteristic of the more severe forms of acne in which scarring sometimes results. Acne lesions are most frequently observed on the face and less frequently on the chest and back, areas of the skin that are rich in sebaceous glands.

**Pathogenesis of Acne**

The pathogenesis of noninflammatory acne lesions (comedones or blackheads) is associated with obstruction of the pilosebaceous canal. According to Strauss and Klingman (1960), if there is no blockage, there is no comedone formation. The primary agent responsible for sebaceous duct blockage is a protein called keratin. There was much more keratin in the sebaceous ducts of patients with acne than in those of control subjects (Holmes, Williams, & Cunliffe, 1972). What happens in acne patients is that horny cells, located in the lower portions of the pilosebaceous duct, become bound together with keratin which acts as a cohesive agent. As the horny cells fail to dehisce, an expanding solid mass accumulates and the duct becomes plugged (Leyden & Klingman, 1976). Another phenomenon found in acne patients is that there are less enzyme-containing granules in their keratin compared to controls (Kuntson, 1974).

Moreover, these enzymes have facilitated separation of the keratin, and their reduction in acne patients has accounted for the greater cohesion of the keratin.
Additional agents that appear to play a role in the early formation of comedones include sebum and bacteria (primarily Propionibacterium acnes). Sebum is a complex lipid secreted by the sebaceous glands. There was overwhelming data which indicated that acne sufferers have a significantly higher rate of sebum excretion compared to non-acne subjects (Cotterill & Cunliffe, 1972; Pochi & Strauss, 1974). It has also been found that acne patients have a greater amount of Propionibacterium acnes, both on their skin surface and in the pilosebaceous canal, than non-acne subjects (Holland, Roberts, & Cunliffe, 1974). What occurred in persons with acne was that Propionibacterium acnes, located in the pilosebaceous duct and skin crevice, released enzymes (lipases) that split fats in sebum into fatty acids. These acids are known irritants that have been found to induce comedone formation in a rabbit's ear (Klingman & Kathy, 1968), and may do so in humans.

Once closed comedones have formed, they are "time bombs" of inflammatory acne. Leakage or rupture of comedonal material into the surrounding skin seemed to initiate the acute inflammatory reaction that characterized the more severe forms of acne (Puhvel & Sakamoto, 1977a). Until early 1977, research had suggested that this inflammatory response was primarily instigated by free fatty acids acting as a powerful skin irritant. However, more recent studies (Puhvel &
Sakamoto, 1977a, 1977b) have found that free fatty acids did not produce more than a very mild inflammatory reaction in human skin.

Puhvel and Sakamoto suggested that there are a combination of factors involved in inciting the inflammatory reaction in acne. These factors included bacterial colonization of the sebaceous follicle (primarily *Propionibacterium acnes*), keratinous debris, and to a lesser extent, free fatty acids.

Thus, the pathogenesis of acne vulgaris is associated with the presence of keratin, sebum, and bacteria in and around a sebaceous gland and hair follicle. However, less is known about the factors which influence the presence of these biochemical agents in acne patients. Factors thought to be involved, either directly or indirectly, include: diet (Rasmussen; 1977), climate (Cunliffe & Williams; 1975), race (Hamilton, Terada & Mestler; 1964), age (Burton, Cunliffe, Stafford & Shuster; 1971), sex (Cunliffe & Shuster; 1969), genetic predisposition (Hect; 1960), and stress (Krauss; 1970). Researchers investigating the etiology of acne are currently in disagreement as to which of the aforementioned factors was most responsible for the development of the disease. Nevertheless, researchers have agreed that acne vulgaris is a disease involving sebaceous glands, which are under endocrine control, the principal stimulus being androgenic (Stewart & Pochi; 1978). Androgenic hormones, which promote masculine
characteristics, also increased the size of and secretion from the sebaceous glands. Although androgens are necessary for the occurrence of acne, they cannot be its prime cause since they are not abnormally high in acne subjects (Pochi & Strauss; 1965). Acne was associated with above average rates of sebum production (Pochi & Strauss; 1974). However, the increased rate of sebum production in acne patients cannot be due to raised androgen production since neither plasma nor urinary testosterone levels are abnormally high in acne subjects (Pochi & Strauss; 1965). Thus, other possible endocrine mechanisms must be considered.

Ebling and Sheffield (1976), suggested that sebaceous gland activity is primarily mediated by pituitary hormones. After reviewing numerous animal and human studies, the authors concluded that: (a) pituitary hormones affect the sebaceous gland by influencing the enzymes which metabolize the androgen at its target sites, and (b) raised sebum production and an increased likelihood of acne appear to be associated with raised serum growth hormone levels in acromegaly. Thus, Ebling and Sheffield argued that pituitary hormones are the most important factor in the pathogenesis of acne vulgaris.

Stress and Acne

In reviewing the sparse literature on the relationship between stress and acne, one finds that the term "stress"
has either not been defined, or has been defined loosely.

Lorenz, Graham, and Wold (1953) found a positive relationship between acne and psychological stress. They investigated 30 patients with acne and identified a characteristic emotional pattern consisting of episodes of anger followed by remorse. They measured sebum excretion and found an increased sebum production when anger was exhibited and a decrease during periods of remorse. The investigators suggested that such phasic alternations influenced the activity of sebaceous glands and played an important role in the pathogenesis of acne.

Lucas and Ojha (1963) conducted a personality study of patients with acne and matched controls using the Maudsley Personality Inventory as their measuring instrument. Although they found no significant differences between patients and controls, 14 acne patients who reported aggravation of their lesions by fatigue or when under stress and they showed higher neuroticism scores. The investigators noted that more female than male patients reported these reactions and suggested that they had higher autonomic activity which, under the impact of stress, led to increased endocrine activity presumably through the pituitary-adrenal axis. This in turn would increase the output of androgen steroids which stimulated sebaceous gland activity.
Kenyon (1966), on the basis of a vast literature review and his own investigations, found inconclusive evidence for acne being initiated by psychological factors. However, he did find that acne was related to endocrine factors and concluded that in the predisposed individual, exacerbations of acne could occur following emotional stress. Krauss (1970) demonstrated a flare-up of acne in medical students (8 males and 1 female) associated with the stress of a compulsory academic examination. Krauss also studied the fatty acid composition of the surface lipids, and demonstrated an increase in the surface lipid fatty acids during the period of stress. Since surface lipid fatty acids are involved in the pathogenesis of acne, Krauss concluded that there was a relationship among stress, skin surface free fatty acids, and acne.

Although none of the aforementioned studies are proof that stress caused the acne, they have suggested an indirect relationship. Stress can cause increased sebum excretion rate, free fatty acid production, and endocrine activity, and these interrelated phenomena are crucial for the pathogenesis of acne.

**Psychophysiological Mechanisms of Acne**

As previously mentioned, research suggests that the pituitary gland is the most important factor in the pathogenesis of acne. The physiological mechanisms by which the
pituitary is involved in the pathogenesis of acne is related to the actions of the hormones secreted by that gland. These hormones are gonadotrophins, growth hormones, adrenocorticotropic hormone (ACTH), and thyroid stimulating hormone (TSH). More specifically, gonadotrophins act indirectly on the sebaceous glands via the ovary and testis by stimulating the production and release of androgens by these organs (Pochi & Strauss, 1974). TSH and growth hormone probably act in a permissive way allowing androgens to stimulate the sebaceous glands (Ebling, Ebling, & Skinner, 1969; Thody & Shuster, 1972). ACTH has an indirect effect on the sebaceous glands via the adrenal glands and adrenal androgen production (Strauss & Klingman, 1959). Thus, gonadotrophins and ACTH have an indirect effect on the sebaceous gland via their target endocrine glands, while TSH and growth hormone probably act in a permissive way, allowing androgens to stimulate these glands.

In humans, the pituitary gland, regulated by the hypothalamus, was stimulated to release hormones under stress stimulation (Leuke, 1972). Consequently, the relationship between stress and acne pathogenesis revolved around one common denominator, namely the pituitary gland. However, before elaborating upon this psychophysiological phenomenon, a more detailed explanation of the term "stress" is necessary.
Selye (1956) defined stress as the rate of all the wear and tear caused by life. Everyone has experienced some degree of stress all the time. Serious disease and intensive physical or emotional trauma are not the only causes of stress. Driving a car, exposure to a cold room, sheer joy of living, all activate stress. Stress is not necessarily bad. According to Selye, it is the spice of life for any emotion or activity causes stress. However, the same stress which makes one person ill can be invigorating to another.

Selye asserted that the secret of health lies in successful adjustment of ever-changing conditions. The penalty for failure is disease. Many common diseases are due to error in adaptive response, rather than direct damage by germs, poisons, or external agents. Many nervous and emotional disturbances, high blood pressure, peptic ulcers, allergic, cardiovascular and renal diseases appeared to be essentially diseases of adaptation. Acne has some of the features of these groups.

In disease, and during stress, there is a specific response, but the body may also react with a nonspecific response which Selye called the General Adaptation Syndrome. This evolved in three stages:

1. The alarm reaction, when the cells of the adrenal cortex discharged their secretion, containing the hormones, into the blood stream. The blood became concentrated and
there was marked loss of body weight. The adrenals enlarge due to congestion and there was shrinkage of the thymus and lymph nodes.

2. The stage of resistance. The cortex accumulated a reserve of secretory granules, the blood was diluted, the body weight returned toward normal.

3. The stage of exhaustion. Here the body entered a third stage strikingly similar to the first.

In tissues directly affected by stress there developed a local adaptation syndrome, similar to inflammation when microbes enter the body. According to Selye (1956) inflammation is a kind of nonspecific auxiliary mechanism of adaption; it acts as a barricade to protect the affected region from overactivity or irritation and allows the tissues and cells to repair itself. This process reflected an essential feature of adaptation; namely, the delimitation of stress to the smallest area capable of meeting the requirements of a situation. However, if irritation continued over a very long period, during which time the affected tissues have not yet been able to repair itself, inflammation will have a negative effect. The directly affected cells eventually break down from fatigue. Should this occur, a stage of exhaustion will begin in which the inflammatory barricade breaks down, spreading the irritation to neighboring regions causing additional alarm signals to reactivate the pituitary and
adrenal cortex. However, after the auxiliary channels become exhausted and the hormonal reserves of these glands depleted, recovery is no longer possible and cell degeneration follows. Thus, inflammation may be either good or bad, depending upon whether or not its barricade-like effect lasts long enough to permit tissue repair. The specific tissues or body regions in which a local adaptation syndrome developed was specific to each individual. In other words, Selye (1956) contended that a selective conditioning process existed to explain why every person reacted somewhat differently to stress depending upon his or her inherited and acquired characteristics. Thus, in some persons the tissues in and around their joints might be most affected by stress, leading to a predisposition to develop arthritis. In others, the local adaptation syndrome and concomitant inflammation and potential degeneration of cells may develop in and around the pilosebaceous unit of the skin, leading to a predisposition to develop acne.

Thus, during stress stimulation, the body reacted in two ways. One reaction was non-specific and pervasive, i.e., the general adaptation syndrome. The other reaction was specific and local, i.e., the local adaptation syndrome.

The general and local adaptation syndromes are inter-related. General stress has influenced local stress-reactions through hormones which regulated information. Conversely,
local stress has produced a general stress reaction. Acne appeared to be a disorder in which general stress influenced a local reaction. More specifically, periods of emotional (general) stress initiate the general adaptation syndrome. Concurrently, some specific cell and tissue regions are directly affected by this stress due to previous selective conditioning, and a local adaptation syndrome occurs. As previously mentioned, if general or emotional stress continued for a prolonged time, local irritation of the tissues and cells directly affected by stress continues and they eventually break down or degenerate from fatigue and exhaustion. This was essentially what appeared to occur when the follicular wall of the pilosebaceous unit breaks down and ruptures, causing the severe inflammatory acne reaction. Again, if this occurred, cell irritation would spread, sending alarm signals that reactivated the pituitary and adrenals, causing them to produce additional adaptive hormones (including ACTH and STH or growth hormone). Thus, the generalized response acts back upon the local region.

Moreover, during this process, the bloodstream was filled with additional hormones (ACTH and STH) and other hormones (including gonadotrophins and TSH) that are released from various endocrine glands (e.g., sex glands and thyroid) that are stimulated by the adaptive hormones.
At this point, let us summarize the implications of the aforementioned reactions for acne pathogenesis. First, the hormones released in the blood stream during stress stimulation included those that are fundamental in precipitating comedone formation and acne. Second, the local adaptation syndrome and the process of selective conditioning of tissues directly affected by stress stimulation appeared to account for an additional phenomena found in acne patients. More specifically, research indicated that if multiple adjacent comedones are involved in the acne process repeated attempts at epithelial repair may produce extensive epithelial lined sinus tracts which may then become chronic sources of inflammation (Kuntson, 1974). Thus, the local adaptation syndrome and process of selective conditioning have explained how multiple adjacent comedones developed (i.e., the spreading of local irritation) and why such skin areas have acquired a tendency to become chronic sources of inflammation (i.e., selection conditioning).

Eventually, stress stimulation should subside when the organism retreats from the situation that elicited the reaction. However, for acne patients, the damage has already been done. Sebaceous gland activity has been highly stimulated and will continue until the pituitary hormones responsible for such stimulation diminish in the bloodstream.
Therefore, the response to stress has a tripartite mechanism consisting of: (a) the direct effect of the stressor upon the body, (b) the internal responses which stimulate tissue defense, and (c) internal responses which cause tissue surrender by inhibiting defense. Resistance and adaptation depend on a proper balance of these three factors. In reducing acne severity, the aim was to achieve this balance. That is to say, to prevent a breakdown in the local adaptation syndrome which "traps" the cortex into continuing a high sympathetic outflow of pituitary hormones. 

Rationale for Utilization of Muscular Relaxation, Guided Cognitive Imagery, and Biofeedback

In humans, emotional stress is accompanied by (a) increased activity of both the pituitary-adrenocortical system (Levi, 1967) and (b) increased synthesis of pituitary thyrotropic and gonatropic hormones, as well as of the thyroid and sex hormones (Levi, 1967). Again, these hormones are fundamental in the pathogenesis of acne. Consequently, it seemed reasonable to assume that acne pathogenesis might be curbed by reducing the patient's level of emotional stress, which in turn would lower the levels of pituitary hormones secreted into the bloodstream. Before we examine how this might be accomplished, we need to further examine the physiological mechanism that governs pituitary hormonal release.
All pituitary hormones are regulated by the hypothalamus (Leuke, 1972). In humans the hypothalamus was in turn regulated by the higher cerebral centers at the level of the cerebral cortex (Kurtsin; 1976). During stress stimulation, cortical activity increased as the cortex sent signals to the limbic system to go into "red alert." Once this occurred, the hypothalamus was activated to send signals which increased sympathetic outflow, causing an increase in the catecholamines epinephrine and norepinephrine. This intense response also caused the hypothalamus to activate the pituitary to higher output so that other hormones, such as growth hormones, are increased. As these hormones and other chemicals circulated in the blood, they activated sexual organs, the thyroid, and the pancreas, which in turn produced their hormones. Soon greater levels of catecholamines, and the hormones, cortisol, growth hormone, testosterone, thyroxine, and insulin, are flowing through the body. The whole body is now bathed in chemicals which include vast amounts of pituitary hormones.

Thus, the physiological mechanism that governed pituitary hormonal release involved increased sympathetic nervous system activity. Does this mean that increased sympathetic nervous system activity per se is detrimental for acne patients since it is accompanied by increased levels of pituitary hormones? The answer to this question is no. It is only detrimental if such activity continues over a
very long period, causing depletion of hormonal reserves, which lead to a state of exhaustion and a breakdown in the local adaptation syndrome. Similarly, physical and mental exertion per se, which was accompanied by increased sympathetic activity, was not detrimental for persons with acne. The critical factor, therefore, was very prolonged stress and increased sympathetic activity which prevented the body from returning to a normal level of arousal. Consequently, if stress and increased sympathetic activity can be interrupted, then the local adaptation syndrome won't break down. Moreover, pituitary hormone levels in the bloodstream will return to normal, leading to normal sebaceous gland activity and decreased acne pathogenesis.
Figure 1. Theoretical physiological model on the relationship between stress and acne pathogenesis.
Gellhorn and Kiely (1972), proposed a model for examining the consequences of muscular relaxation, especially its effects on other bodily systems. They first cited the work of Hess (1954) concerning the distinction between ergotropic and trophotropic systems. The ergotropic system consisted of an increase in sympathetic discharge, in increased skeletal muscle tone, and in cortical excitation. The trophotropic syndrome is associated with increased parasympathetic discharges, relaxation of skeletal muscles, and lessened cortical activity.

Gellhorn and Kiely proposed that the balance between ergotropic and trophotropic systems may be altered in two fundamentally different ways: (a) By direct stimulation of ergotropic or trophotropic "centers" in the hypothalmus or other cerebral centers and (b) By indirectly altering the activity of these two systems. This may be accomplished either by input from the cerebral cortex or by changing afferent input impinging on the reticular formation and hypothalmus. Particularly effective in changing proprioceptive input are discharges from the muscle system. Gellhorn (1958) has shown, in animal preparations, that reduction of proprioception through curare-like drugs greatly reduced the ergotropic responsiveness of the hypothalmus and diminished hypothalmic-cortical discharges. The loss of muscle tone produced by these drugs resulted in behavioral sleep. That is to say, there was a shift towards trophotropic activity.
Gellhorn and Kiely (1972) suggested that it was this mechanism which accounted for many of the similarities between progressive relaxation and autogenic training. In both, muscular relaxation resulted in reduced proprioceptive input to the hypothalmus, a diminution of hypothalamic-cortical discharges, and in a dominance of the trophotropic system through reciprocal innervation. Consequently, there was a decrease of sympathetic nervous system activity.

The neurophysiological model proposed by Gellhorn and Kiely (1972) has received support from numerous investigators (Beary, Benson, & Klemchuk; 1976; Lehrer; 1978; and Wallace, Benson, & Wilson; 1971) who have found that muscular relaxation reduced sympathetic nervous system activity.

Thus it appeared that muscular relaxation provided a viable means for treating acne patients. More specifically, it allowed the patient to interrupt excessive sympathetic activity which in turn prevented a breakdown in the local adaptation syndrome around the sebaceous gland.

If, as a great deal of evidence suggested, muscular relaxation resulted in the production of lower sympathetic activity, then a technique that augmented and refined such training would be of great value. EMG (electromyographic) biofeedback has been found to be such a technique (Budzynski; 1973; Schwartz & Beatty; 1977; Sittenfeld, Budzynski & Stoyva; 1972; Wenger & Cullen; 1972).
Although muscular relaxation produced lower sympathetic arousal, its success was dependent upon the discrimination by the patient of very subtle proprioceptive and interoceptive sensations. Discriminations of this sort seemed to be difficult for those individuals who needed the most training, that is, those who suffered from stress-related disorders. Since their levels of arousal are frequently high, these persons tend to become adapted to, and therefore lacked an awareness of these sensations. Consequently, training effectiveness could be improved by the addition of a technique that would aid in the development of these fine discriminations.

A second advantage of employing EMG biofeedback in conjunction with progressive muscular relaxation was that it provided an indirect objective measure of sympathetic nervous system activity. Budzynski and Stoyva (1975) found that EMG readings indicative of such activity were considerably more accurate than an individual's verbal report.

A third advantage of biofeedback training was that it gave the patient an opportunity to do something for himself rather than being the passive recipient of a therapeutic procedure of a physician. It demonstrated to the patient that he or she has control over autonomic bodily functions.

Finally, the innovation of biofeedback as a new technique which involved unusual instrumentation, feedback displays, and the idea of self-control was a very good
placebo (Stroebel & Gleuck; 1973). Parenthetically, there was nothing wrong with placebo effects. Indeed, Miller (1974) cited a number of studies in which powerful effects on physiological responses, including blood pressure, could be obtained by pill placebos and simple suggestions. In the final analysis, the value of therapeutic procedure depended upon how effective it was in bringing the symptom or illness under control.

Thus, in the present study, EMG biofeedback was employed as a means to: (a) aid in the training of muscular relaxation, (b) objectively monitor the patient's level of sympathetic arousal, (c) demonstrate to the patient that he or she can control autonomic bodily functions, and (d) enhance or facilitate lower sympathetic arousal via a possible placebo effect.

Before discussing the final component (guided cognitive imagery) of our proposed treatment method, it should be mentioned that recent research suggested that EMG feedback training combined with relaxation was of help in treating stress-related dermatologic disorders. Lamontagne (1976), reported a case study in which he used such treatment on a 61 year old female suffering from prurigo nodularies, a rare skin disease manifested by solitary or multiple itchy modules dispersed over the skin. After receiving 10 sessions of EMG feedback concomitant with home relaxation exercises, the patient showed significant improvement (the number of
modules had decreased 40%) in her condition. At a six month follow-up, during which time relaxation at home was continued, her improved condition was maintained.

Haynes, Wilson, Jaffe, and Britton (1979), reported eight controlled case studies of patients suffering from atopic dermatitis, an inflammatory disease, in which they applied a three-phase treatment program consisting of assessment, placebo, and EMG biofeedback combined with relaxation. The 12 session intervention package resulted in a significant reduction of the dermatological problem for these 8 cases across treatment, and none of the patients reported a worsening of the condition when contacted nearly a year after treatment. In discussing their findings, the authors stated that a large proportion of the improvement was due to nonspecific elements of the treatment program such as assessment reactivity, attention, demand, or placebo and the efficacy of each of the combined treatment components were not independently assessed. Nevertheless, the investigators concluded that the skin condition was amenable to behavioral intervention procedures.

The final component of the proposed treatment involved the use of guided cognitive imagery. This mode of treatment might best be explained by first presenting the following documented case study of Bowers (1976). The patient that he treated was a 40-year-old female who was diagnosed by skin specialists as having a chronic case of hidradenitis
suppurative, a sort of colossal acne caused by a tendency for the sebaceous glands to become infected and form huge pimples. In the course of a three month treatment period, Bowers administered repeated suggestions for the patient to imagine herself being sprayed by or swimming in shimmering, sunlit liquids that would purify and cleanse her skin. He also told her to become aware of her skin and to experience it as warm and cold, as prickly and smooth-suggestions that constituted lessons in skin awareness and control. She was further instructed to imagine her skin as smooth and unblemished.

At the end of treatment, the patient was virtually free of sores. Bowers further reported that a 2 year follow-up revealed that the skin problem was still under control. In discussing his results Bowers stated that he was not certain what "ingredient" or combination of ingredients was responsible for the dramatic remission of symptoms; whether suggestion was essential to the cure, or the vivid imagery, or both. Nevertheless, it did seem certain that the effective remedy was psychologically induced.

The Bowers (1976) case study illustrated two important aspects of guided cognitive imagery. First, the therapist promoted certain ideas (i.e., lessons in skin awareness and control, and imagining remission of the disease process). Second, a large degree of autonomy was provided for the patient (i.e., the specific images that constituted the instructed events to be imagined are left completely up to the
patient). In discussing the latter aspect of guided cognitive imagery, Leuner (1977) asserted that each specific image developed spontaneously from its predecessor. Moreover, such idiosyncratic images hold special significance and meaning for the patients which more powerfully influenced their attitudes and physiological reactions than do mandatory images.

According to Achterberg and Lawlis (1978), guided cognitive imagery constituted the basis for a new movement in behavioral medicine. Based upon an extensive review of the imagery literature and their own investigations, the authors concluded that what the patient images ought to happen, following therapist promoted ideas, directly guided disease progress or remission. In short, if one discovered that cognitive images produced a desired physiological change, then engaging in such imagery promoted the change. Thus, guided cognitive imagery, as applied to treating disease processes, involved: (a) relaxation, (b) educating the patient as to what autonomic systems need to be energized or slowed down, and (c) encouraging the patient to image their recovery. According to Achterberg and Lawlis, this type of cognitive restructuring resulted in a state of mind conducive to remediation at the very least, with the potential of significant healing at best. Consequently, this therapeutic procedure should aid acne patients in treating themselves.
Finally, guided cognitive imagery, as applied to treating disease processes, also involved having the patient relax prior to engaging in imagery. The reason for employing relaxation techniques and guided cognitive imagery together is twofold. First, achievement of muscular relaxation seems to greatly enhance the production of visual images (Richardson, 1969). Total relaxation seems to be required in order for the patient to focus internally, to obliterate the demands made on the central nervous system by the maintenance and experience of muscular tension, and to gate out diversionary external stimuli. Second, the ability to achieve a relaxed state usually requires imagery to some extent. For example, the patient usually images tension in some way flowing out of the body; he sees muscles changing in their form and state; the body warming via some internal production of heat. Thus, employing imagery and relaxation together should enhance their respective beneficial effects.

**Purpose of Study**

The primary purpose of the present study is to demonstrate that acne vulgaris can be reduced by psychological treatment. Towards this purpose, self-management relaxation and imagery procedures aimed at providing one group of acne patients with a means to interrupt excessive sympathetic activity was employed. This accomplishment should prevent a breakdown in the local adaptation syndrome around the sebaceous gland, which is hypothesized as the major factor
contributing to excessive sebaceous gland activity and acne pathogenesis.

A second purpose of the study was to demonstrate that any treatment effects are attributable to the procedures employed rather than to medication and lesion extraction or any of the following potential artifacts: (a) experimenter-induced treatment program, (c) experimenter contact with the subject, and (d) self-attention by subjects in treating themselves. To control for these variables a group therapy attention-comparison group was run that paralleled the treatment group in terms of involving the same number of sessions and daily home practice assignments, during the same period of time. Additionally, both groups received similar experimenter-induced treatment expectations and were exposed to similar demand characteristics during treatment. Extreme care was taken which insured that none of the hypothesized therapeutic components of the treatment group (biofeedback apparatus, relaxation, or imagery procedures) were in the comparison group. A third group of acne patients receiving the same medical intervention (medication and lesion extraction) as subjects in the above two mentioned groups were routinely monitored to control for dermatological treatment effects. Finally, in order to explore personality changes as a function of treatment, subjects in the treatment and comparison groups will take the Sixteen Personality
Factor Questionnaire (16 P. F.) pre- and posttreatment. Four, second-order factors (anxiety, tough poise, extraversion, and independence) served as dependent measures of emotional adjustment.

It was hypothesized that subjects in the treatment group would show significant improvement in their acne conditions as compared to subjects in the comparison group and patients in the control group. Additionally, it was hypothesized that the comparison and the control group would not differ significantly from each other. It was also anticipated that subjects in the treatment group would exhibit very low EMG readings while engaging in either cue-controlled relaxation or guided cognitive imagery. Furthermore, it was hypothesized that there would be no significant difference between EMG readings taken during cue-controlled relaxation and guided cognitive imagery.

Method

Subjects

A total of 22 patients with a clinical diagnosis of acne vulgaris participated in this study. All subjects were recruited at the Acne Health Care Center in Hollywood, Florida. A notice was posted at the clinic inviting patients to sign up to attend one of five lecture-presentations entitled How Stress is a Cause of Acne and What You Can Do About It (see Appendix A). Fifty-five potential patient participants signed up to attend one of the presentations, of which 28 persons actually attended. Criteria for inclusion in the
sample were: (a) a medical diagnosis of acne vulgaris; (b) a daily pharmacological regime of topical benzoyl peroxide and sulfur lotion, and topical erythromycin ointment; (c) attendance at the clinic for lesion extraction on a monthly or bi-monthly basis; and (d) a minimum two year history of the disease. Subject group assignment was determined by initially forming matched pairs according to age, sex, and pretreatment acne severity. One subject from each matched pair was then assigned to either the treatment or attention-comparison group, depending upon their availability to attend evening attention-comparison group sessions. One medical treatment control patient was selected from the clinic population and matched to each of the above mentioned pairs to form matched trials. The control patients were selected on the basis of medical records without their knowledge of the selection process. Of the 22 subjects beginning the study, one dropped out due to illness during the pre-treatment baseline phase and one moved to another state midway through treatment. Any data collected on these persons was omitted from the study. Table 1 presents the demographic characteristics of the remaining 20 matched subjects and 10 control patients.

Immediately following each lecture, potential participants in the treatment and attention-comparison groups were invited to register for the treatment program. Those who agreed to participate: (a) signed a form on
Table 1
Demographic Characteristics of Acne Patients

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Note: Acne = pretreatment acne severity grade assigned by judges. Mos. = months of dermatological treatment at the clinic prior to the study.

which they certified their consent (see Appendix B), (b) were examined and rated on acne severity, (c) were photographed, (d) were scheduled for an individual appointment in 2 weeks, and (e) paid a $25 registration fee to help defray costs for treatment materials that would later be theirs to keep. All participants remained under the care of the clinic dermatologist throughout the study.
Although the clinical staff knew which patients were participating in the study, they remained blind as to which group the subjects were assigned.

**Apparatus**

**Assessment tools.** To assess each patient's acne severity, the acne grading method using photographic standards devised by Cook, Centner, and Michaels (1979) was applied. This method was chosen because of demonstrated high reliability and validity. Interrater reliability between two judges has been shown to increase slightly as familiarity and use of the grading method continued. The correlation coefficients between judges at week 3 and 12 are .785 and .891, respectively. Additionally, the method permitted verification of results at some later date and allowed for comparisons between different studies. The grading scale yielded an overall severity score from 0 to 9.

The 16 P. F. (Form A) was administered to explore patient personality changes across treatment. This instrument was chosen because of demonstrated high reliability and validity. Additionally, test norms are based upon the general population from which patients in this study were drawn. The instrument yielded second-order factor scores (extraversion, anxiety, tough poise, and independence) that reflected shifts in emotional adjustment across therapy. The inventory yielded tden scores ranging from 1.0 through 10.0 ($\bar{x} = 5.5$, S.D. = 2.0).
The 5-point scale by which subjects rated their expectancy of treatment effectiveness is shown in Appendix C. All subjects recorded their diets for 48 hours pre- and post-treatment to informally review the eating habits of acne patients (see Appendix D). In order to evaluate subject faithfulness to home practice, home practice log sheets were devised for subjects in the attention-comparison (see Appendix E) and treatment (see Appendix F) groups. The log sheet for treatment group subjects incorporated a 5-point scale for subjectively rating the level of relaxation attained during each home practice session. Additionally, the log sheet permits comparisons between the level of relaxation attained during self-relaxation versus relaxation during cognitive imagery while listening to the treatment tape.

One record form was used by the investigator to collect data on subject treatment expectancy ratings, baseline EMG level, and rater- and self-graded acne severity scores (see Appendix G). Another record form was devised to collect biofeedback data for subjects in the treatment group (see Appendix H). Appendix I presents the follow-up questionnaire mailed back by treatment group subjects.

Equipment. A Cyborg, Model J33, portable EMG instrument was used in the study. The instrument provided: (a) continuous metered readings of EMG output in the range of .7-1000 microvolts, and (b) visual and audio feedback which varied proportionally to the integrated EMG output level.
Filter bandpass specifications were 100-1000 Hz. Three silver-chloride electrodes, 15 mm in diameter, placed 25 mm above the eyebrows and spaced 102 mm apart on the subject's forehead were used. The ground electrode was medially placed. Audio feedback was provided through the instrument speaker.

A prerecorded audio cassette tape, lasting 18 minutes, contained imagery and relaxation instructions along with an explanation of why people have acne (see Appendix J for a transcription).

Attention-comparison group subjects used The Create Your Own Happiness Kit developed and distributed by the Rational Behavior Therapy Center at the University of Kentucky College of Medicine. The kit contained: (a) the book Help Yourself to Happiness Through Rational Self-Counseling (Maultsby, 1975), (b) a pamphlet outlining the Ten Safe Steps For Creating Your Own Happiness, and (c) a prerecorded cassette tape entitled and motivating listeners to Give Yourself A Happier Day. The kit's imagery tape was omitted for the purposes of this study, as were readings from chapters 7 and 11-17, and steps 8 and 10 of the pamphlet.

A Minolta 35 mm single-lens reflex camera with a lens of 85 to 105 mm focal length was used to take color photographs of each subject's face throughout the phases of the study. Exposures were made at an aperture of f/16 using
Kodak Ektachrome slide film with an A.S.A. of 64, under controlled lighting conditions.

A Panasonic cassette tape recorder was used to play the imagery tape for subjects in the treatment group on days they attended sessions at the clinic. Subjects borrowed or bought similar tape recorders for their home practice sessions.

The treatment area for subjects in the biofeedback-assisted relaxation-imagery (treatment) group was a dimly lit examining room measuring approximately 2.5 x 3 meters. It contained a cushioned examining table on which the patient could lie with head slightly elevated, a wall mirror, and a small table and chair for the therapist. The EMG apparatus was on the small table adjacent to the examining table.

The treatment area for subjects in the group therapy attention-comparison condition was a well lit patient waiting room approximately 3.5 x 4 meters. It contained 12 small chairs positioned circularly around the room, and two small tables on which laid magazines.

Procedure

Pretreatment Baseline Period. A 4-week baseline period began immediately following subject recruitment at the end of the aforementioned lecture. One of two acne health care nurses from the clinic examined and graded the acne severity for all subjects and control patients throughout the study.
using the grading method of Cook et al. (1979). After examining and grading, the nurse photographed the subject to create a permanent and verifiable record of each subject's clinical status throughout the study. During the investigation, an attempt was made to standardize lighting conditions and subject-camera placement under which photographs were taken.

After being examined and photographed on the day of the lecture, each subject was scheduled to return to the clinic in two weeks for an individual appointment. At these visits the subject's acne was examined, graded, and photographed.

After being photographed, the subject entered the treatment room and laid down on a cushioned examining table as the experimenter read a brief explanation of the use of the EMG equipment (see Appendix K). Electrodes were placed on the subject's frontalis region and EMG output was hand recorded for six consecutive 120-second intervals that determined pretreatment EMG levels. The mean of the final two interval readings served as the baseline measure.

After the baseline EMG reading was taken, the electrodes were disconnected and the subject got off the examining table and sat in a chair. The subject was given the scale to rate his/her expectancy of treatment effectiveness. Next, the subject self-graded his/her acne condition by studying his/her face in a mirror and comparing the acne with that on the faces of persons in the set of photographic standards
handed him/her. The experimenter recorded the subject's responses to the above mentioned tasks. Following the collection of this data, the subject was given, to take home and complete, the 16 P.F. questionnaire and answer sheet, and the diet count record form on which to list foods consumed in a 48-hour period. The subject was informed that the session was over and that he/she would be notified by phone of the exact time to return in two weeks to begin treatment. The subject was also asked to bring in the completed personality and diet forms on that visit.

Throughout the study, each subject's acne condition was examined, graded, and photographed at regular two week intervals. Each subject's pretreatment acne grade was determined by averaging the grades assigned to him/her at weeks one, three, and five of the study. Similarly, the posttreatment acne grade consisted of the average of the grades assigned at weeks seven, nine, and eleven. Acne grades assigned at weeks thirteen and fifteen were averaged to determine the follow-up grade.

At the conclusion of the pretreatment baseline period, matched triads were formed among subjects and control patients in the manner previously described.

**Biofeedback-Assisted Relaxation-Imagery Treatment.**

**Phase I: Biofeedback-assisted relaxation training.**

After the 4-week pretreatment baseline period, subjects assigned to this group were initially trained in general
relaxation utilizing EMG biofeedback during two 1-hour sessions scheduled within a 1 week period. At the beginning of the first of these sessions subjects were given the following rationale:

Acne is a disorder of the sebaceous gland. Acne development involves a chain of various physiological reactions. In short, excessive sebaceous gland stimulation causes these glands to become plugged, and rupture within the skin resulting in an inflammatory reaction. If one link of this chain is broken, then the development of your disease process will be halted. This will prevent new acne lesions from developing, and will give old ones a chance to heal and go away.

During your first two sessions you will learn the first step to take towards breaking this chain. At this point, it is important for you to know that a major factor contributing to excessive sebaceous gland stimulation is stress-induced physiological arousal. Such arousal increases the level of sebaceous gland stimulating hormones in your body. Using biofeedback training, you will learn to reduce muscle tension which lowers stress-induced physiological arousal thus decreasing the level of sebaceous gland stimulating hormones in your body. In short, biofeedback training will enable you to indirectly inhibit your excessive sebaceous gland activity which is the first step towards breaking
the chain of acne development. You will learn the necessary final steps that you can take in order for you to clear up your acne during your fifth session. Therefore, do not be discouraged if you do not experience treatment benefits following your first four sessions.

Subjects were trained individually during the two sessions with each session consisting of similar procedural components. A typical session began with the placement of electrodes on the subject's frontalis region, while the subject was seated in a reclining chair. Electromyographic output was recorded at 120-second intervals throughout each session. For the first 10 minutes, the subject was given standard reading material while an EMG baseline was obtained. Following this 10 minute period subjects were told:

Most people are able to exercise some voluntary control over their autonomic bodily functions. Some people can alter their blood pressure or heart rate in this manner. The muscle tension in your forehead is no exception to this. For the next 10 minutes, I would like you to relax your forehead through any nonphysical method you desire. You may try one strategy or many different ones, as long as they do not involve any physical activity. Remember, try to reduce the tension in your forehead as much as you can. Ready? Begin. Following the 10-minute self-directed relaxation period, the subject was then told:
You will now begin to receive audio feedback that will inform you as to how relaxed you actually are. You will hear a tone that will increase in pitch as muscle tension increases; conversely, the tone will decrease in pitch as muscle tension decreases. I would like you to lower the pitch of the tone as much as possible by relaxing. Ready? Begin.

Audio feedback was then initiated. After a period of 30 minutes, the electrodes were disconnected and the subject informed that the session was over. Acne severity evaluation and facial photographs were obtained immediately after the first of the two relaxation training sessions. The subject was then scheduled to return for sessions three and four the following week.

Prior to the third session, data from the first two 30-minute biofeedback training periods were used to derive an individual relaxation criterion for each subject. This criterion consisted of the higher of the two consecutively lowest 120-second interval EMG readings during that subject's two biofeedback training periods. The criterion was used to denote optional times for pairing a cue with the subject's most relaxed state during cue-controlled relaxation trials in the next ten sessions.

Phase II: Biofeedback-assisted Cue-Controlled Relaxation Training.
The third session was similar to the previous two in that it included a 10-minute EMG baseline period, a 10-minute self-directed relaxation period, and a 30-minute training period incorporating EMG biofeedback. Cue-control procedures were employed during the 30-minute period immediately upon the subject's achievement of two consecutive 120-second intervals at or below that subject's relaxation criterion. Cue-control procedures were initiated by disconnecting the auditory feedback and then asking the subject to focus his/her attention on his/her breathing. He/she was told to take deep breaths and exhale slowly while saying subvocally the word "relax". The experimenter repeated the word aloud in synchrony with the subject's exhalation five times, then the subject was instructed to continue this procedure 15 additional times, during which the experimenter kept count. The subject was next instructed to focus his/her attention on his/her general sensations of relaxation for a period of approximately 1 minute, at which time the auditory feedback was reinstated. For the purpose of this study, the 20 pairings of the cue word with 20 exhalations followed by approximately 1 minute of focused attention on the sensations of relaxation constituted one cue-controlled relaxation trail. If the criteria for initiating the cue-controlled relaxation trial had not been
met prior to the 14th minute of the 30-minute training period, the first trial was run at that time. The criteria for beginning the second and third cue-controlled relaxation trials were the same as those for the first. If the subject had not achieved the relaxation criteria by the 20th and 26th minute of the training period, the second and third trials were started at those times, respectively. After the 30-minute period of cue-controlled relaxation training, the subject was informed that the session was over, and the electrodes were disconnected. Acne severity examination and grading, and facial photographs were obtained from subjects immediately after the session ended.

The fourth session was similar to the third in that it included a 10-minute EMG baseline period at the beginning and a 30-minute training period at the end incorporating EMG biofeedback with cue-control procedures. The middle 10-minute self-directed relaxation period was replaced by 10 minutes of self-directed cue-controlled relaxation without audio feedback.

At the end of the fourth session, each subject was told:

You have done very well. You have completed the first step towards breaking the chain of acne development. That is to say, you have learned to indirectly inhibit your excessive sebaceous gland activity by becoming very relaxed and lowering your physiological arousal. During your next session, I
will also provide you with a prerecorded audio tape that teaches you how to control and redirect the major autonomic physiological reaction that contributes to acne development. Following this session, you will have learned all the necessary procedures that are involved in your breaking the chain of acne development.

The subject was then scheduled to return for session five the beginning of the following week.

**Phase III: Biofeedback-assisted Cue-Controlled Relaxation and Guided Cognitive Imagery Training.**

The fifth session consisted of similar procedural components as the fourth, except that the initial 10-minute EMG baseline period was omitted. The session began with a 6-minute period of self-directed cue-controlled relaxation without audio feedback, followed by a 30-minute training period incorporating EMG biofeedback with cue-controlled procedures. Immediately following this 30-minute training period subjects were told:

>You have done very well. Learning to use the cue to relax quickly will enable you to lower your physiological arousal and indirectly inhibit your excessive sebaceous gland activity. You have also learned an extremely important concept during this process. That is, by controlling your thought processes you can control and redirect your body's physiological functioning that previously was not under your
conscious control, with selected imagery as well as, with biofeedback. In other words, instead of using thoughts to control your body's reactions, you can also learn how to picture in your mind images of the physiological response that you want to take place so that you can achieve the desired effect. Now, I would like you to listen to a prerecorded audio tape that will instruct you on how to use imagery to control and redirect a crucial autonomic reaction that is necessary for acne development, namely the plugging up and blocking of the sebaceous gland pore. At this point, it is important for you to know that if there is no blockage of the pore then there is no acne. This is precisely the link that you can break in the chain of bodily responses responsible for acne development. You have already learned how to weaken this link by indirectly inhibiting excessive sebaceous gland activity which is a major contributing factor to the plugging up and blockage of the sebaceous gland pore. You will now learn how to completely break this link and halt the development of your acne. Get ready to listen to the tape that I will now play.

Electromyographic output was recorded at 120-second intervals while the subject listened to the tape, without feedback being given.
After listening to the tape recording, the electrodes were disconnected and the subject was informed that the session was over. The subject was then told:

You have now learned all the necessary procedures that will be involved in your treatment program. In order for you to effectively and quickly clear up your acne you must incorporate these procedures on a daily basis. I propose that in the beginning you listen to the tape recording before breakfast and just before going to sleep. I would also like you to spend at least five minutes doing your self-relaxation exercise before lunch and suppertime. Remember, it takes time and regular practice doing these procedures in order for you to effect a reduction in the severity of your acne. Therefore, do not be discouraged if you do not experience treatment benefits immediately. Do you have any questions?

After having any questions answered, the subject's acne was graded and photographed, and he/she was given a copy of the tape along with a log sheet on which to record the time of home practice sessions and subjective impression of his/her level of arousal during the session. The subject was then scheduled for a sixth session later in the week and for six additional sessions, spread evenly over the following three week period. The procedure for the sixth through twelfth treatment sessions was identical to the fifth. On days the subject came in, this laboratory session
took place of one imagery and one cue-controlled home practice session. After each laboratory session, home practice log sheets were inspected by the experimenter and the subject was reminded to practice at home. Another expectancy rating was obtained for each subject immediately following the last treatment session.

**Group Rational Behavior Therapy Attention-Comparison Group.** After the 4-week pretreatment baseline period, subjects assigned to this group met with the experimenter for a total of 12 group therapy sessions. Like those subjects in the treatment group, subjects in this group met for 12 1-hour sessions evenly spaced over a 6-week period. In addition, during the latter 4-week period, subjects in this group each engaged in daily home-practice exercises as part of their treatment program. Thus, subjects assigned to the group therapy attention-comparison group received the same number of sessions and daily home practice assignments, during the same period of time, as did subjects in the biofeedback-assisted relaxation-imagery treatment group. Also, like subjects in the treatment group, comparison group subjects had their acne condition graded and photographed biweekly throughout the course of the study.

At the beginning of the first of these sessions subjects were given the following rationale:

**Acne is a disorder of the sebaceous gland. Acne development involves a chain of various physiological**
reactions. In short, excessive sebaceous gland stimulation causes these glands to become plugged, and rupture within the skin resulting in an inflammatory reaction. If sebaceous gland stimulation is reduced then the severity of your acne will also decrease. At this point, it is important for you to keep in mind that a major factor contributing to excessive sebaceous gland stimulation is emotional stress. When you are emotionally stressed or upset, your bloodstream bathes your body with stress hormones. Unfortunately, most of these stress hormones are also sebaceous gland stimulating hormones. Consequently, when you are under emotional pressure or stress, especially for prolonged periods of time, your acne condition worsens considerably. Conversely, when you are under minimal emotional strain and don't allow yourself to remain emotionally upset for prolonged periods of time your acne condition becomes less severe.

The treatment that you will receive will provide you with a method that will help you to experience emotional stress and upset less frequently and less intensely than you now do throughout your daily life. By achieving this, you will be lowering the levels of stress hormones in your bloodstream which should result in improvement of your acne condition. During your initial four group sessions, you will learn the
basic concepts of rational self-counseling, the treatment method that this group will receive. During your fifth session, you will receive treatment materials that will enable you to put those concepts into effect in order for you to clear up your acne. Therefore, do not be discouraged if you do not experience treatment benefits following your first four sessions.

The basic structure of the group remained constant throughout all sessions. More specifically, the group: (a) met on Monday and Thursday evenings from 7 p.m. - 8 p.m., (b) remained closed to new members, (c) required active involvement of each member in terms of participating in group tasks and completing assigned homework, (d) consisted of the experimenter as a nonparticipant leader who functioned as a facilitator, instructor, and role model.

The content of group sessions one through four were similar in that they consisted of a 40-minute lecture by the experimenter followed by a 20-minute question and discussion period over the lecture material presented. The lectures involved transmitting the content and concepts presented in chapters one through four of Help Yourself to Happiness Through Rational Self-Counseling, with one chapter being covered each group session. Thus, during the first four sessions, group members learned the basic concepts presented in the first section of the text as
evidenced by their correct responses to the "emphasis questions" at the end of each chapter.

At the end of the fourth session, subjects in the group were told:

You have done very well. You have completed learning the basic concepts behind Rational Self-Counseling. During your next session I will provide you with a treatment kit that tells you how to put some of the concepts you learned into effect. Following this session, you will be able to apply a method that will help you to rid yourself of unwanted negative emotions and emotional stress most of the time. By doing so, you will be able to effect an improvement in your acne condition.

At the beginning of the fifth session, each group member received his/her own Create Your Own Happiness Kit, with the imagery cassette tape having already been removed. During this session, the experimenter explained to the group how to use the materials contained in the kit, and played the kit's audio cassette recording describing how to give yourself a happier day. In order to maintain the integrity of the study's experimental design as well as to insure standardized treatment for all members of the group, the subjects were instructed to follow the kit's procedural steps according to the following schedule and modifications:

(a) not to progress beyond Step 6 of the procedural pamphlet
until after week four of treatment, (b) read at home section 2 of the text, omitting imagery chapter 7, during week three, (c) read at home section 3 of the text during week four, (d) after week four follow the remaining procedural steps as instructed in the pamphlet, with the exception of omitting steps 8 and 10, and (e) do at least three written Rational Self-Analyses per week instead of one as instructed in procedural step 9 of the pamphlet. Please refer to Appendix L for a condensed description of the procedural components, used in this study, from the kit's pamphlet *Ten Safe Steps for Creating Your Own Happiness*. The reader may review the complete *Help Yourself to Happiness Kit* by obtaining such from the Rational-Behavior Therapy Center at the University of Kentucky College of Medicine.

After the group listened to the tape recording, they were told:

>You have now learned about all the necessary procedures that will be involved in your treatment program. In order for you to effectively and quickly clear up your acne you must incorporate these procedures on a daily basis. I propose that in the beginning you listen to the tape recording before breakfast and just before going to sleep, as instructed in step 6 of your kit's pamphlet. I would also like you to spend at least five minutes, before lunch and suppertime, following the remaining steps for
creating your own happiness as instructed in the procedural pamphlet with the modifications I gave you. Remember, it takes time and regular practice doing these procedures in order for you to effect a reduction in the severity of your acne. Therefore, do not be discouraged if you do not experience treatment benefits immediately. Do you have any questions?

After having any questions answered, subjects had their acne condition graded and photographed, and were given a log sheet on which to chart their progress in completing home-practice assignments. The content for group sessions six through twelve were similar in that they consisted of group discussion pertaining to homework assignments. More specifically, sessions six through eight focused on the content in chapters read from the text and sessions nine through twelve consisted of practicing writing Rational-Self Analyses. On evenings the group met, the session replaced one tape listening and one text reading home practice session. After each group meeting, home practice log sheets were inspected by the experimenter and subjects were reminded to practice at home. Another expectancy rating was obtained for each subject immediately following the last treatment session.

Medical Treatment Control Group. Since the acne conditions of all patients at the clinic were routinely graded and photographed, it was possible to monitor the acne
condition of the selected control patients without their knowledge. Patient right to privacy was insured by assigning numbers to replace the names on the clinic charts of the selected control patients. Only the clinic's office manager had a list of the patient names corresponding to the assigned patient numbers. Patients in this group only received the clinic's regular topical pharmacological and lesion extraction dermatological treatment.

Posttreatment Baseline Period. The posttreatment baseline period was conducted in the same manner as the pretreatment baseline period. Each subject was scheduled to be photographed biweekly during a four week period. All subjects were reminded to continue their respective homepractice assignments each time they came in to be photographed.

Results

Table 2 summarizes the treatment means for each group on all of the dependent measures taken during the study. The primary hypothesis that subjects in the treatment group will show significant improvement in their acne condition as compared to subjects in either the comparison or control group was fully supported. Table 3 shows pre-, post-, and follow-up analysis of numerical grades of acne severity rated by the judge based upon the evaluation method of Cook et al. (1979). Data generated from the acne grading method show significant differences for the combined groups and the significant interaction indicates the patterns are nonparallel.
Table 2
Summary of Treatment Means on Dependent Measures for Each Group

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Treatment</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>F.U.</td>
<td>Pre</td>
<td>Post</td>
<td>F.U.</td>
<td>Pre</td>
<td>Post</td>
<td>F.U.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acne-Judge</td>
<td>4.10</td>
<td>3.00</td>
<td>3.50</td>
<td>3.90</td>
<td>3.60</td>
<td>3.30</td>
<td>4.20</td>
<td>4.00</td>
<td>3.60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acne-Self</td>
<td>3.10</td>
<td>2.10</td>
<td>N/A</td>
<td>3.00</td>
<td>2.20</td>
<td>N/A</td>
<td>--</td>
<td>N/A</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expectancy</td>
<td>2.20</td>
<td>1.90</td>
<td>N/A</td>
<td>2.80</td>
<td>2.20</td>
<td>N/A</td>
<td>--</td>
<td>N/A</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraversion</td>
<td>5.31</td>
<td>5.33</td>
<td>N/A</td>
<td>5.41</td>
<td>5.93</td>
<td>N/A</td>
<td>--</td>
<td>N/A</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tough Poise</td>
<td>5.85</td>
<td>5.92</td>
<td>N/A</td>
<td>5.62</td>
<td>6.67</td>
<td>N/A</td>
<td>--</td>
<td>N/A</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td>6.46</td>
<td>7.25</td>
<td>N/A</td>
<td>5.92</td>
<td>6.72</td>
<td>N/A</td>
<td>--</td>
<td>N/A</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>6.21</td>
<td>5.58</td>
<td>N/A</td>
<td>5.95</td>
<td>5.64</td>
<td>N/A</td>
<td>--</td>
<td>N/A</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMG</td>
<td>2.81</td>
<td>1.94</td>
<td>N/A</td>
<td>--</td>
<td>N/A</td>
<td>--</td>
<td>--</td>
<td>N/A</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N/A - Not Applicable
According to a \( t \) test for post scores of group differences, subjects in the treatment group show a significant reduction in the acne as compared to subjects in either the comparison (\( t[18] = 2.72, p < .05 \)) or the control group (\( t[18] = 3.87, p < .01 \)). No significant differences were found at posttreatment between the comparison and control group (\( t[18] = 1.50, p > .05 \)).

Table 3

Analysis of Variance for Repeated Measures of Pre-, Post-, and Follow-Up Acne Grades

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment vs. Comparison vs. Control (B)</td>
<td>2</td>
<td>1.37</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Error B</td>
<td>27</td>
<td>4.71</td>
<td></td>
</tr>
<tr>
<td>With Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acne Severity Changes for Combined Groups (A)</td>
<td>2</td>
<td>3.24</td>
<td>11.23**</td>
</tr>
<tr>
<td>A X B</td>
<td>4</td>
<td>.81</td>
<td>2.80*</td>
</tr>
<tr>
<td>Error W</td>
<td>54</td>
<td>.28</td>
<td></td>
</tr>
</tbody>
</table>

\*\( p < .05 \)

\**\( p < .01 \)

In order to maintain statistical integrity, the data was partitioned into three further analyses for the three
groups during this period with the treatment group improving significantly more than either of the other two groups. The posttreatment-follow-up analysis shows no significant treatment changes for the combined groups, and that there were differential effects relative to the treatment received. The latter finding apparently reflects the decrease in acne severity for both the comparison and control group and the increase in acne severity for the treatment group during this period. The pretreatment-follow-up analysis

Table 4
Analyses of Variance for Repeated Measures of Partitioned Acne Grade Data Rated by the Cook et al. Method

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Posttreatment Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Subjects</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment vs. Comparison vs. Control (B)</td>
<td>2</td>
<td>1.55</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Error B</td>
<td>27</td>
<td>3.46</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acne Grade Changes for Combined Groups (A)</td>
<td>1</td>
<td>4.27</td>
<td>18.28**</td>
</tr>
<tr>
<td>A X B</td>
<td>2</td>
<td>1.21</td>
<td>5.21**</td>
</tr>
<tr>
<td>Error W</td>
<td>27</td>
<td>.23</td>
<td></td>
</tr>
</tbody>
</table>
Table 4—Continued

<table>
<thead>
<tr>
<th>Source</th>
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</thead>
<tbody>
<tr>
<td><strong>Posttreatment-Follow-up Analysis</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Between Subjects</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment vs. Comparison vs. Control (B)</td>
<td>2</td>
<td>1.55</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Error B</td>
<td>27</td>
<td>2.92</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acne Grade Changes for Combined Groups (A)</td>
<td>1</td>
<td>.07</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>A X B</td>
<td>2</td>
<td>1.22</td>
<td>5.05*</td>
</tr>
<tr>
<td>Error W</td>
<td>27</td>
<td>.24</td>
<td></td>
</tr>
</tbody>
</table>

| Pretreatment-Follow-up Analysis           |    |     |       |
| Between Subjects                          | 29 |     |       |
| Treatment vs. Comparison vs. Control (B)  | 2  | .47 | < 1   |
| Error B                                   | 27 | 3.32|       |
| Within Subjects                           | 30 |     |       |
| Acne Grade Changes for Combined Groups (A)| 1  | 5.40| 13.75*|
| A X B                                     | 2  | 0.00| < 1   |
| Error W                                   | 27 | .39 |       |

*P < .01
indicates that while significant decreases in acne severity are found for the combined groups, there are no differential effects relative to the treatment received. Figure 2 is a graphic representation of the above mentioned patterns of change in acne severity for each of the three groups.

The hypothesis that subjects in the treatment group will exhibit lower EMG readings across treatment while engaging in either cue-controlled relaxation or guided cognitive imagery was supported. To summarize the effectiveness of the biofeedback training, an analysis of variance source table for the data from baseline through nine is presented in Table 5. Data analysis shows a significant decrease in EMG levels across treatment.

Figure 3 is a graphic representation of the linear decline of muscle tension in the biofeedback-assisted relaxation-imagery group for baseline through session twelve. Further review of Figure 3 confirms that the greatest reduction in muscle tension took place between the baseline and initial biofeedback training session.

The hypothesis that there will be no significant difference between EMG readings taken during cue-controlled relaxation ($\bar{x} = 2.11$) versus guided cognitive imagery ($\bar{x} = 2.0$) was also supported by a $t$ test for correlated
Figure 2. Cook et al. ratings of acne severity grades plotted separately for the treatment, comparison, and control groups.
Table 5
Analysis of Variance for Repeated Measures on EMG Data

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMG Changes Across Treatment (A)</td>
<td>9</td>
<td>.59</td>
<td>53.87*</td>
</tr>
<tr>
<td>Residual</td>
<td>81</td>
<td>.01</td>
<td></td>
</tr>
</tbody>
</table>

*p < .01

observations (t [9] = .22, N.S.). This finding, in combination with the data on EMG readings across treatment, shows that cue-controlled relaxation and guided cognitive imagery were equivalent in effectively enabling subjects to reduce muscular tension and increase relaxation over the course of treatment.

Although there was no hypothesis concerning subject expectancy of treatment effectiveness, this was investigated to rule out its operating as a non-specific effect influencing treatment outcome. Table 6 summarized the data analysis of numerical subjective ratings of expectancy of treatment effectiveness pre- and posttreatment. This analysis reveals no significant differences, and indicates that subjects in both the treatment and the comparison group had similar
Figure 3. EMG biofeedback readings from baseline through Session 12 for the relaxation-imagery group.
expectations regarding the effectiveness of their respective treatments for reducing acne severity.

Personality changes as a function of treatment were explored by subjects taking the 16 P.F. pre- and post-treatment. Four second-order factors (anxiety, tough poise, extraversion, and independence) served as dependent measures.

Table 6
Analysis of Variance for Repeated Measures of Subjective Ratings of Expectancy of Treatment Effectiveness

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment vs. Comparison (B)</td>
<td>1</td>
<td>2.02</td>
<td>1.69</td>
</tr>
<tr>
<td>Error B</td>
<td>18</td>
<td>1.19</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expectancy Shifts for Combined Groups (A)</td>
<td>1</td>
<td>2.02</td>
<td>3.55</td>
</tr>
<tr>
<td>A X B</td>
<td>1</td>
<td>.22</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Error W</td>
<td>18</td>
<td>.56</td>
<td></td>
</tr>
</tbody>
</table>

of emotional adjustment. Table 7 summarizes the data analysis generated from the subjects responding to the 16 P.F. administered pre- and posttreatment. Significant personality trait changes are seen on each of the four second-order factors assessed. Although the groups do not differ significantly in their pattern of change on the independence and anxiety
Table 7
Analysis of Variance for Repeated Measures of Data from 16 P.F. Second-Order Factor Scores

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
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<tbody>
<tr>
<td><strong>Extraversion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Subjects</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment vs. Comparison (B)</td>
<td>1</td>
<td>1.22</td>
<td>1.1</td>
</tr>
<tr>
<td>Error B</td>
<td>18</td>
<td>9.64</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personality Changes for Combined Groups (A)</td>
<td>1</td>
<td>.72</td>
<td>4.95*</td>
</tr>
<tr>
<td>A X B</td>
<td>1</td>
<td>.62</td>
<td>4.25*</td>
</tr>
<tr>
<td>Error W</td>
<td>18</td>
<td>.14</td>
<td></td>
</tr>
<tr>
<td><strong>Tough Poise</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Subjects</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment vs. Comparison (B)</td>
<td>1</td>
<td>.67</td>
<td>.1</td>
</tr>
<tr>
<td>Error B</td>
<td>18</td>
<td>10.41</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personality Changes for Combined Groups (A)</td>
<td>1</td>
<td>3.13</td>
<td>5.57*</td>
</tr>
<tr>
<td>A X B</td>
<td>1</td>
<td>2.40</td>
<td>4.26*</td>
</tr>
<tr>
<td>Error W</td>
<td>18</td>
<td>.56</td>
<td></td>
</tr>
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</table>
Table 7—Continued

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<th>Source</th>
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<tbody>
<tr>
<td><strong>Independence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Subjects</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment vs. Comparison (B)</td>
<td>1</td>
<td>2.86</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Error B</td>
<td>18</td>
<td>5.49</td>
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</tr>
<tr>
<td>Within Subjects</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personality Changes for Combined Groups (A)</td>
<td>1</td>
<td>6.32</td>
<td>10.00**</td>
</tr>
<tr>
<td>A x B</td>
<td>1</td>
<td>.00</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Error W</td>
<td>18</td>
<td>.63</td>
<td></td>
</tr>
<tr>
<td><strong>Anxiety</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Subjects</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment vs. Comparison (B)</td>
<td>1</td>
<td>.10</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Error B</td>
<td>18</td>
<td>5.25</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personality Changes for Combined Groups (A)</td>
<td>1</td>
<td>2.20</td>
<td>11.95**</td>
</tr>
<tr>
<td>A x B</td>
<td>1</td>
<td>.25</td>
<td>1.38</td>
</tr>
<tr>
<td>Error W</td>
<td>18</td>
<td>.18</td>
<td></td>
</tr>
</tbody>
</table>

* p ≤ .05  
** p ≤ .01
measures, the combined groups appear to significantly increase on independence and decrease on anxiety from pre- to post-treatment (see Table 8). On both the extraversion and tough poise second-order factors there is a significant increase across treatment for the combined group, and differential effects are seen across groups. The significant interaction for both these factors indicates these patterns of change are nonparallel. A \( t \) test for post scores of group differences yields nonsignificant results for both extraversion (\( t \) \([18] = .66, \ p > .05 \)) and tough poise (\( t \) \([18] = .69, \ p > .05 \)) on post scores.

Table 8

Summary of Treatment Means on Dependent Measures for Combined Groups

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acne-Judge</td>
<td>4.07</td>
<td>3.53</td>
<td>3.47</td>
</tr>
<tr>
<td>Acne-Self</td>
<td>3.05</td>
<td>2.15</td>
<td>N/A</td>
</tr>
<tr>
<td>Expectancy</td>
<td>2.50</td>
<td>2.05</td>
<td>N/A</td>
</tr>
<tr>
<td>Extraversion</td>
<td>5.36</td>
<td>5.63</td>
<td>N/A</td>
</tr>
<tr>
<td>Tough Poise</td>
<td>5.73</td>
<td>6.29</td>
<td>N/A</td>
</tr>
<tr>
<td>Independence</td>
<td>6.19</td>
<td>6.98</td>
<td>N/A</td>
</tr>
<tr>
<td>Anxiety</td>
<td>6.08</td>
<td>5.61</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note: N/A - Not applicable
Despite only approaching statistical significance at the .05 level, the group differences between post scores for extraversion and tough poise are noteworthy upon inspection of the data. It visually appears that the subjects in the comparison group tend to increase more on measures of extraversion and tough poise across treatment as compared to subjects in the treatment group. Figure 4 graphically represents the linear incline for pre- and posttreatment second-order factor scores: extraversion, tough poise, independence and the linear decline of anxiety for both groups.

Although there was no hypothesis regarding each subject's self-grading of their acne condition at pre- and posttreatment, such data was collected and analyzed in order to make some comparison between ratings of acne severity by judges vs. subjects, utilizing the Cook et al. (1979) method. Table 9 presents that analysis of numerical reports of subject-rated pre- and posttreatment acne severity grading by the Cook et al. method. No significant differences are found between groups, suggesting that subjects in both the treatment and comparison groups perceive a similar improvement in their acne condition across treatment.

In comparing the mean acne severity grade scores at pre- and posttreatment for the treatment and comparison groups combined, with subject self-grading at those times, it appears that subjects in both groups consistently tend
Figure 4. 16 P.F. Second-Order Factor Scores plotted separately (Pre = Pre-treatment, Post = Posttreatment)
### Table 9
Analysis of Variance for Repeated Measures of Pre- and Posttreatment Acne Grades
Subject-Rated by the Cook et al. Method

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Between Subjects</strong></td>
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<td></td>
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<td>Relaxation-Imagery vs. Group RET (B)</td>
<td>1</td>
<td>0.00</td>
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<tr>
<td>Error B</td>
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<tr>
<td><strong>Within Subjects</strong></td>
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<tr>
<td>Reported Self-Rated Changes for Combined Groups (A)</td>
<td>1</td>
<td>8.10</td>
<td>30.37**</td>
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<tr>
<td>A X B</td>
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<tr>
<td>Error W</td>
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<td>.26</td>
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</tbody>
</table>

**p < .01**

to evaluate their acne condition as less severe, before and after treatment, compared to judged evaluations. Figure 5 is a graphic representation of this comparison.

Considering that the treatment effects were not maintained at follow-up for the relaxation-imagery subjects, their frequency of home practice both during and after treatment was analyzed. It was found that the mean number of home practice sessions, during the four-week treatment phase in which such practice was required, was 94.1 as opposed to a group mean of 29.4 during the four-week follow-up period.
Figure 5. Mean Cook et al. acne severity grades by judges vs. subjects for the treatment and comparison groups combined, pre- and posttreatment.
According to a $t$ test for correlated observations, there was a significant reduction in the amount of home practice for treatment group subjects from treatment to follow-up ($t_{[9]} = 14.1, p < .01$). This finding reflects the fact that only 30% of the treatment group subjects reported having continued home practice procedures during the follow-up period. It is also noteworthy that there was no change in acne severity scores from post-treatment to follow-up for any subjects in the group that had continued the home practice procedures as opposed to a mean increase in acne severity of .71 for the group of relaxation-imagery subjects who had discontinued the at-home procedures. This finding indicates that only the group of relaxation-imagery subjects who had discontinued home practice procedures during the follow-up period contributed to the worsened acne condition that was found for the treatment group from posttreatment to follow-up.

**Discussion**

The results of this research provide strong support for the efficacy of biofeedback-assisted relaxation-imagery therapy as an adjunctive treatment for patients with chronic acne vulgaris. This study is the first to demonstrate that acne vulgaris can be further reduced, in patients already receiving traditional dermatological treatment, with an adjunctive cognitive-behavioral intervention. As hypothesized the biofeedback-assisted cue-controlled relaxation and
guided cognitive imagery (relaxation-imagery) treatment was found to significantly reduce acne severity more than the attention-comparison and medical control treatments. The second hypothesis, which holds that the attention-comparison and control group conditions would not significantly differ from each other, was also confirmed. The hypotheses concerning predicted subject EMG levels during treatment were also supported. That is to say, subjects in the treatment group did exhibit equally low EMG readings while engaging in either cue-controlled relaxation or guided cognitive imagery.

**Acne Severity Changes**

Although changes in the acne condition are statistically significant, it is important to determine if such changes are clinically significant in the opinion of dermatologists. According to Cook et al. (1979), a one grade point change using their grading method constitutes a clinically "important" difference. In this study, group sizes are such that a 1.0 grade point reduction in acne severity is statistically significant at almost the .001 level. Thus, the 1.0 grade point difference at posttreatment, between the treatment and control group, is statistically significant at the p < .01 level, and minimally clinically significant according to the above mentioned criterion for change of one grade point. Since this is a clinical study, the reader might better be served if the results pertaining to acne severity changes is
interpreted and discussed in terms of the more highly stringent one grade point or clinically significant criterion for change, as well as the statistically significant changes that were found.

Across the pre-posttreatment period, only the treatment group displayed a clinically significant decrease in the severity of the acne condition. At posttreatment, there was a significant statistical and clinical difference between the treatment control group, attesting to the efficacy of the relaxation-imagery treatment. Although the attention-comparison group was clinically similar to the treatment and control groups at posttreatment, statistical results indicate that the acne condition of the group was the same as that of the control group and significantly more severe than that of the treatment group. Thus, statistical findings for the attention-comparison group suggest that experimenter contact with subjects, and self-attention by subjects in treatment themselves, had no significant effect on the acne condition of subjects in this study. Concomitant clinical findings for the attention-comparison group neither confirm nor disconfirm the latter conclusion.

Across the 14-week pretreatment-follow-up period, there was a statistically significant reduction in the acne severity across all groups at follow-up (with none of the groups differing from each other), but no difference in terms of clinical importance. These findings reflect a
variety of observed circumstances. First, that there was no significant clinical improvement in the acne condition of patients receiving 14 weeks of dermatological treatment is not surprising since the average subject-patient had been receiving such treatment at the clinic for approximately one year prior to this study, during which time significant clinical improvement in their acne condition had already been documented. That they continued to show only a mild (0.6 grade point) clinical decrease in their acne severity over the 14-week period of dermatological treatment during the study, is quite understandable. Second, that across the 14-week pretreatment-follow-up period, the acne condition of treatment group subjects showed only approximately the same mild clinical improvement as displayed by the comparison and control group subjects, is highly noteworthy. This occurrence reflects the worsening in the acne condition of treatment group subjects across the one month posttreatment-follow-up period, during which there was a significant reduction in their frequency of home practice. Despite having been asked by the experimenter to continue their respective at-home exercises, the vast majority of treatment (70%) and comparison (90%) group subjects reported having self-terminated their at-home assignments at posttreatment. Thus, subjects in both the treatment and comparison group inadvertently created a nearly perfect no treatment baseline-treatment-no treatment baseline experimental design.
Viewing the acne severity changes for the treatment and comparison groups, across the pretreatment-follow-up period, within the A-B-A experimental framework, reconfirms and strengthens the following aforementioned conclusions. First, the clinically significant decrease in the acne severity of treatment group subjects at posttreatment was probably due to the effects of the treatment they received since discontinuation of such treatment correlated with a flare-up of their acne condition. To fully support this contention, future research would be required in which subjects return to treatment after follow-up, thus creating an A-B-A-B design. Second, the consistent gradually mild pattern of decline in acne severity for comparison group subjects remained uninterrupted across all phases of the study suggesting that there were no significant intervention effects for this group. The latter conclusion is substantiated by the parallel direction of change in acne severity displayed by the comparison and control groups.

Electromyographic Biofeedback Training

The hypothesis that treatment group subjects would exhibit very low EMG readings during laboratory sessions was supported. It was found that treatment group subjects attained significantly lower levels of frontalis muscle tension readings across treatment, indicating their having learned the relaxation response. The correlative hypothesis, which held that treatment group subjects would attain an equally
low level of muscle tension while engaging in cue-controlled relaxation or guided cognitive imagery was supported. This objective finding was relatively congruent with subject responses on their home practice log sheets where they subjectively rated their level of relaxation while engaging at home in cue-controlled relaxation or imagery. Moreover, experimenter inspection of these ratings revealed that the average subject experienced increasingly deeper levels of relaxation throughout the course of self-treatment at home, paralleling the progress they showed in the laboratory. This suggests that the self-report of the state of relaxation is fairly reliable for persons having had biofeedback relaxation training.

The results concerning acne severity changes in combination with the biofeedback data appear to lend some support to the theoretical treatment rationale presented in this paper. In review, it was theorized that acne pathogenesis could be reduced by having patients interrupt and lower their excessive sympathetic activity. It was thought that accomplishment of this feat would decrease cellular breakdown and irritation around the follicular wall of the pilosebaceous unit, an occurrence contributing to acne development. Since muscular relaxation has been shown to reduce sympathetic nervous system activity (Gellhorn and Kiely, 1972), the treatment group subjects, who frequently engaged in muscular relaxation, might have shown greater improvement in their
acne condition because they promoted less cellular irritation around the follicular wall of the pilosebaceous unit. Admittedly, such physiological phenomena would have to be empirically observed and measured via biochemical analyses before the latter contention could be more fully upheld. Nevertheless, the results of this research are at least compatible with the treatment rationale presented.

Personality Factors

In brief, the second-order personality factor extraversion represents persons on a scale of warmth, impulsivity, boldness, and self-sufficiency. The tough poise factor is associated with a general level of emotionality. Individuals high on this factor tend to be more poised and less emotional than persons with low scores. The factor measuring independence reflects the tendency of an individual to like to do things his/her own way. The anxiety factor is self-descriptive, and reflects a general state of the individual.

In the present study, treatment and attention-comparison group subjects engaged in experimenter-assisted self-help procedures aimed at reducing the level of stress in their daily lives. That subjects in both groups felt more independent and less anxious after treatment is not surprising. All subjects actually behaved more independently by actively participating in their acne treatment. Despite getting assistance from the experimenter, all subjects did more things on their own and by themselves (i.e. at home
self-treatment) which reflects functioning in a more independent fashion. They no longer had to rely exclusively on a physician or nurse for help in treating their acne condition. Since the relaxation-imagery and group rational behavior therapy (R.B.T.) conditions consisted of procedural components directly aimed at reducing physical and emotional tension, respectively, a decreased feeling of anxiety for all subjects is also quite understandable.

Subjects in the treatment and comparison conditions appeared to exhibit a marked graphic trend in differing along the dimensions of extraversion and tough poise, at the end of treatment. Subjects in the relaxation-imagery condition showed virtually no change across treatment, in terms of feeling less emotional and more outgoing, while group R.B.T. subjects did. Increased extraversion for R.B.T. subjects could reflect either their more frequently interacting with relative strangers in a group situation or their feeling more confident and comfortable with themselves following 12 sessions of group therapy. That R.B.T. subjects felt less emotional or more poised after treatment is compatible with one of the fundamental goals of R.B.T., i.e. to be more objective in terms of how you perceive yourself and the events in your daily life. Admittedly, any or all of the slight personality shifts observed in subjects from either the treatment or comparison group could be a function of the
demand characteristics implicit within the procedural components of their respective treatments.

It should be noted that at pretreatment, the sten scores of the average subject in this study were within average limits for each of the four second-order personality factors. Thus, the personality of individuals with acne in this study did not appear to be significantly different from that of the average person in the general population. At posttreatment, the average subject obtained a sten score of seven on the independence factor, which is obtained by 15% of the adults in the general population. This was the only factor on which subjects, on the whole, scored slightly higher than average at posttreatment.

**Treatment Effectiveness Expectancy and Self-Evaluations**

At pretreatment, the average subject in both treatment conditions reported expecting in between a moderate to large improvement in their acne condition from the adjunctive treatment that they would receive. In other words, they expected the results of their adjunctive treatment to be in between good to very good. At posttreatment, the average subject in both treatment conditions evaluate the effectiveness of the respective treatment as good. That is to say, they thought that their acne condition had improved a moderate amount from the adjunctive treatment. Thus, the opinion of subjects from both groups was similar in that their perception of treatment effectiveness at posttreatment
approached their pretreatment expectations. However, actual posttreatment acne severity changes were different for each group. For subjects in the relaxation-imagery condition, the magnitude of improvement in their acne condition was clinically significant from before and after treatment, implying that their posttreatment impressions of treatment effectiveness was realistic. Although there was no significant clinical improvement in the acne condition, across treatment, for subjects in the comparison group, they inaccurately perceived a moderate degree of improvement in their acne condition. Apparently, these subjects self-exaggerated their mild skin improvement at posttreatment, possibly as a means to reduce cognitive dissonance.

In terms of self-grading one's own acne, all subjects, on the average, consistently graded their acne severity as being one grade point below the corresponding severity rating of the judges. Thus, it appears that self-evaluations by acne patients of the severity of their skin condition might be reliable if one adds a one grade point correction factor onto their self-grade.

Relaxation-Imagery Group Feedback

From the follow-up questionnaire returned by all treatment group subjects one month after posttreatment the following information was obtained. All subjects felt that they were "generally better" from participating in biofeedback/relaxation training. As a group, these subjects felt that
the adjunctive treatment program along with their pharmacological regime was responsible for the improvement in their acne condition during the course of their participation in the study. The percentage of this improvement that they attributed to the adjunctive treatment ranged from 15-100%, with 65% as the mean. All subjects reported that they would recommend the program to other acne patients. In reply to a question asking which things about the program helped them to change their condition, subjects most frequently checked off the following statements: (1) learned to relax at home, (2) learned to recognize and avoid stress, (3) learned not to react to stress that caused the symptom, and (4) that you were working on your symptom.

General Observations

The major conclusion drawn from the research is that biofeedback-assisted relaxation and guided cognitive imagery is an effective adjunctive treatment for further reducing the acne severity in a select population of patients already receiving traditional dermatological treatment. An important consideration in the conclusion is the notion of a select population of acne patients. The subjects who participated in this study were probably not representative of the "average" acne patient. They were a highly select group in terms of: (a) being 80% female; (b) being interested in learning more about the relationship between stress and acne; (c) desiring, and paying a modest fee for, an adjunctive
self-treatment; and (d) having relatively high expectations for treatment effectiveness. Indeed, they were a highly motivated group of individuals which probably accounts for the low attrition rate in this study. Admittedly, due to the process of subject self-selection, it is possible that the relaxation-imagery treatment will only be effective for those acne patients who seek out such treatment. Moreover, the treatment might only work best for females who believe that stress is the primary cause of their acne condition. On a more positive note, a variety of potential treatment artifacts were controlled for through the attention-comparison group. It can be safely concluded that the observed treatment artifacts were controlled for through the attention-comparison group. It can be safely concluded that the observed treatment effects were not the result of: (a) demand characteristics of the treatment, (b) experimenter-expectations, and (c) experimenter-contact with subjects. Although the quality of experimenter attention differed between the treatment and comparison group subjects, the amount of contact was the same. It could even be argued that subjects in the group condition received at least as much therapeutic attention, qualitatively speaking, as did subjects in the relaxation-imagery condition.
That is to say, peer-group emotional support and interaction was an additional form of therapeutic attention provided these subjects.

The fact that only 30% of the treatment group subjects continued self-treatment at the end of their laboratory sessions raises a couple of issues. First, it may be possible that a common phenomenon inherent in most psychological self-treatments is that continued self-treatment for prolonged periods is the exception rather than the rule. Perhaps weekly or bimonthly laboratory treatment sessions incorporated into treatments that are primarily self-administered would serve as a means to foster continued client involvement with the therapeutic procedure. In the follow-up questionnaire returned by treatment group subjects, all the respondents indicated that they would like to return for "tune-up" laboratory sessions if they were offered in the future.

Second, continued home practice for relaxation-imagery group subjects is probably necessary in order for them to maintain the improved acne condition that they displayed at posttreatment. This contention is suggested by the following observed correlative relationships: (a) all subjects who continued home practice maintained the positive treatment effects shown at posttreatment, and (b) as a group, subjects who discontinued home practice failed to maintain the improved acne condition that was found after treatment.
Since this is the first study of its kind, there are numerous implications for future research. Most obviously, the necessary and sufficient components of the relaxation-imagery treatment should be identified via additional research. Components of the treatment package that should be studied separately and in new combinations include: imagery, biofeedback, cue-controlled relaxation, and frequency of laboratory and home practice sessions. For example, a future investigation could add one treatment group consisting of the cue-controlled relaxation procedure alone, with another treatment group solely employing the guided cognitive imagery procedure. Such an investigation could determine either that both procedures are needed concurrently and are ineffective by themselves, or that one procedure is more efficacious than the other in reducing acne severity. The importance of various patient characteristics should also be examined further in future studies. For example, adjunctive stress-management procedures might be maximally effective for patients with severe acne and minimally effective for patients with mild acne. The chronicity of the disease might also be a significant factor affecting treatment efficacy. It would also be important to examine the effects of relaxation-imagery therapy on persons with acne who do not receive dermatological treatment. Additionally, biochemical dependent measures, such as stress hormone levels, should also be investigated in assessing treatment
effects. Thus, the present study appears to raise many more questions than it does answers, and it provides numerous directions for future research.
Appendix A

Outline of Lecture of Explanation

Title of Lecture: How Stress is a Cause of Acne and What You Can Do About It

Title of Study: A Comparison of the Effectiveness of Two Adjunctive Stress Management Treatments for Acne Vulgaris

Investigator's Name: Barry W. Brown, M.A.

Lay Lecture to Insure Informed Consent:

I. Hormonal Basis for Acne Development
   A. Sebaceous Gland Hormones
   B. Pituitary Hormones and Acne
      1. Sex hormones and ACTH
      2. Growth hormone and TSH

II. Hormonal Relationship Between Stress and Acne
   A. Pituitary Hormone Effects During Stress
      1. Increase sebum excretion
      2. Increased free fatty acid production
      3. Increased androgen production
   B. Effects of Prolonged/Uninterrupted Hormonal Release

III. Definition of Stress and Stressors
    A. Selye's Concepts
       1. Stressors
       2. The stress-response
          a. General
          b. Local
B. Adapting to Stress

C. Diseases of Adaptation
   1. Hypertension
   2. Peptic Ulcers
   3. Allergies
   4. Acne

IV. How Stress-Management May Reduce Acne
   A. Interrupt Prolonged Sympathetic Activity
      1. Decreases chance of cellular breakdown
      2. Provides opportunity for physical recuperation
   B. Lower Levels of Acne Stimulating Hormones
      1. Previously attempted via estrogen therapy
         a. Menstrual disturbances in women
         b. Undesirable feminine characteristics in men
      2. May be accomplished via stress-management

V. Stress-Management Procedures
   A. Biofeedback-Assisted Relaxation-Imagery
      1. The relaxation response
         a. Hypometabolic state
         b. Slows bodily reactions
      2. Guided cognitive imagery
         a. Educative
         b. Patient participates in healing process
   B. Rational Self-Statements
      1. Decrease unwanted stressors
         a. Tension and anxiety
         b. Depression and guilt
2. Promotes calm and relaxation
   a. Less frequent stress reactions
   b. Decrease negative effects of stress

C. Treatment Materials

VI. Treatment Requirements

A. Data Collection
   1. Photographs
   2. Personality inventory
   3. EMG readings
   4. Record diet for 4 days

B. Office Visits

C. Homework Assignments

D. Follow-up Visits
Appendix B

Consent Form

Your participation in this study will help us better understand how stress influences your acne condition, and how adjunctive stress-management techniques may be effective in reducing the disease. With this information we can then provide more comprehensive treatment for other patients.

You are under no responsibility to continue in the treatment study should you wish to withdraw your consent, nor would failure to sign the consent form influence the care you will receive in this clinic.

Any questions you have will be fully answered.

Consent:

Having read the information statement and had the opportunity to ask questions, I hereby willingly consent to participate in this study.

Date____________________ Signed____________________
(Patient—if 18 or older)

Time____________________ Witness____________________
Appendix C

Expectancy of Treatment Effectiveness

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<thead>
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<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
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<td>Small</td>
<td>Moderate</td>
<td>Large</td>
<td>Very Large</td>
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<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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**Note:** Poor - Excellent refers to description of treatment effectiveness.

Very Small - Very Large refers to degree of improvement in acne condition.
Appendix D

48 Hour Diet Count

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<tr>
<td>Dinner</td>
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<tr>
<td>Snacks and Between Meals</td>
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<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
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</thead>
<tbody>
<tr>
<td>Food/Drink</td>
<td>Amount</td>
</tr>
</tbody>
</table>

Instructions

1. Keep this sheet on your person for the two days you record all food/drink. Don't rely on memory. Record the type and amount of intake immediately after consuming.

2. Amount may be expressed in ounces, glasses, slices, or any standard measure.

3. After Day 1 or 2, write in the day.
Appendix E

Home Practice Log Sheet

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<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
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<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
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Please record the number(s) of the Ten Steps for Creating Your Own Happiness that you have taken each day.
## Appendix F

### Home Practice Log Sheet

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<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
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<tr>
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<td></td>
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</tr>
</tbody>
</table>

**Note:** Using the scale below, please fill in a number from 1-5 to rate your impression of how relaxed you were during each home practice.

1 Not Relaxed  
2 Barely Relaxed  
3 Moderately Relaxed  
4 Quite Relaxed  
5 Extremely Relaxed
## Appendix G

**Patient Data Record**

Form 4001  
Revised 3-26-79  
Acne Health Care Centers International, Inc.

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<th>NAME:</th>
<th>S.S.#:</th>
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<th>RACE</th>
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<th>LOCATION:</th>
<th>Grade: I II III IV V VI VII VIII</th>
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<table>
<thead>
<tr>
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<th>Pre-Treatment</th>
<th>Post-Treatment</th>
<th>Follow-Up</th>
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<td>DAY</td>
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<td>LRCFW</td>
<td>LRCFW</td>
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<td>Pustules</td>
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<tr>
<td>TOTAL GRADE</td>
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Comments: (Concurrent RX, etc.)

Expectancy Treatment Effect:
Self-Grading of Acne:
Initial Baseline EMG: microvolts

NOTES ON OPPOSITE YN YN YN YN YN YN YN YN YN YN
SIDE
INSTRUCTIONS: Notice that the questionnaire is divided roughly into 4 parts. Part I asks about the time before you had your biofeedback or relaxation. Part II relates to your biofeedback or relaxation sessions themselves and some possible changes that resulted from them. Part III asks about the present time. It is important that you indicate that you have considered every question, so on those questions that do not apply to you, place "NA" beside the number.

PART I: As you read each question in this part, remember that it is asking about the time before you began your biofeedback or relaxation visits.

I-1. Describe the condition for which you had biofeedback/relaxation.

Chronic Acne Vulgaris

I-2. In all, how many months or years had you had the condition?

0 ( ) Less than 6 months
1 ( ) More than 6 months but less than 1 year
2 ( ) More than 1 year but less than 3 years
3 ( ) More than 3 years but less than 5 years
4 ( ) More than 5 years but less than 10 years
5 ( ) More than 10 years
I-3. How often did the condition bother you?

( ) Daily ( ) Weekly ( ) Bi-weekly ( ) Month

0 1 2 3

( ) Less frequently

4

I-4. Would you describe your discomfort as the time from this condition as:

( ) Very mild ( ) Mild ( ) Moderate ( ) Intense

0 1 2 3

( ) Almost unbearable

4

I-5. At that time, what made the condition better?

I-6. At that time, what made the condition worse?

I-7. Was the condition worse at a particular time of day?

( ) No ( ) Yes If Yes, when?

I-8. Once the condition began, how many hours or days did it usually last?

0 ( ) Less than 1 hours

1 ( ) More than 1 hour but less than 12 hours

2 ( ) More than 12 hours but less than 24 hours

3 ( ) More than 24 hours

4 ( ) More than 2 days

5 ( ) More than a week
I-9. How did your condition limit your activities?

0 ( ) Not at all
1 ( ) Mildly; could do most regular activities
2 ( ) Moderately; could do only a few regular activities
3 ( ) Severely; could do only very essential tasks
4 ( ) Completely; had to remain in bed and could carry out no regular activities

I-10. On the scale from 0-10, indicate your ability to relax before your biofeedback/relaxation sessions:

No relaxation ___________ Very deep
00 01 02 03 04 05 06 07 08 09 10 relaxation

I-11. Use this space for any comments about your condition before any biofeedback and/or relaxation.

PART II: As you read each question in this part, remember that it is asking about the time during your biofeedback/relaxation sessions.

II-1. When did you start your biofeedback/relaxation?

( ) Spring ( ) Summer ( ) Fall ( ) Winter of
0 1 2 3

(Year)

II-2. How often were your visits?

0 ( ) More than twice a week
1 (X) Twice a week
2 ( ) Once a week
3 ( ) Less than once a week
Appendix I—Continued

II-3. How many visits did you have?

( ) Less than 10  ( ) 10  (X) More than 10

0 1 2

( ) More than 15  ( ) More than 20

3 4

II-4. Did you have home practice?  ( ) No  (X) Yes

If yes, was it:  (X) Tape recording  ( ) Exercises

2

( ) Other:  (specify)  

3

II-5. What kind of biofeedback did you have?

( ) None  ( ) Alpha  (X) Muscle  ( ) Other (specify):

0 1 2 3

II-6. Did you use a:

(X) Tone  ( ) Light  ( ) Other (specify):

0 1 2

II-7. On a scale from 0-10, indicate your ability to relax at the end of your visits:

No relaxation  Very deep

0 1 2 3 4 5 6 7 8 9 10 relaxation

II-8. At the end of your visits, how often would you say your original condition bothered you?  ( ) Daily

( ) Weekly  ( ) Bi-weekly  ( ) Monthly  ( ) Less frequently

1 2 3 4

( ) Not at all 5
Appendix I--Continued

II-9. At the end of your visits, would you describe your discomfort from this condition as: ( ) None
( ) Very mild ( ) Mild ( ) Moderate ( ) Intense

II-10. Listed below are some statements about the various things which you may feel helped you change your condition. Please check (X) all of the appropriate statements and rank the three most important ones, 1, 2, and 3.

___ That you were working on your symptom.
___ That you learned to relax your muscles.
___ That you were working with someone on your symptom.
___ That you learned to control your brain waves.
___ That you learned to relax at home.
___ That you learned to blank your mind.
___ That you learned to avoid the stress that caused the symptom.
___ That you learned not to react to the stress that caused the symptom.
___ That you learned to recognize early tension.
___ That you learned to oppose tension.
___ That someone was helping you with your symptom.
___ That you expected to feel better.
II-11. Use this space for any comments about your biofeedback/relaxation, including any comment regarding home practice:

PART III: As you reach each question in this part, remember that it is asking about the time since the end of your biofeedback/relaxation visits.

III-1. How long has it been since your last visit?
   0 (X) Less than 6 months
   1 ( ) More than 6 months but less than 1 year
   2 ( ) More than 1 year but less than 2 years
   3 ( ) More than 2 years but less than 3 years
   4 ( ) More than 3 years

III-2. How often does your original condition now bother you?
   ( ) Daily ( ) Weekly ( ) Bi-weekly ( ) Monthly
   0 1 2 3
   ( ) Less frequently ( ) Not at all
   4 5

III-3. At the present, is your discomfort from the original condition?
   ( ) None ( ) Very mild ( ) Mild ( ) Moderate
   0 1 2 3
   ( ) Intense ( ) Almost unbearable
   4 5

III-4. How often do you still practice your home exercises?
   ( ) Daily ( ) Weekly ( ) Bi-weekly ( ) Monthly
   0 1 2 3
   ( ) Less frequently
   4
( ) Not at all (about how long ago did you stop?)

( ) I had no home exercises

III-5. Has another condition replaced the original one?

( ) No ( ) Yes

If yes, please answer questions a, b, c, and d below:

a. Describe the condition:________________________

b. When did this condition begin?________________

c. Would you say this condition bothers you:

( ) Daily ( ) Weekly ( ) Bi-weekly ( ) Monthly

( ) Less frequently

d. Would you describe your discomfort from this condition as:

( ) Mild ( ) Moderate ( ) Severe ( ) Unbearable

III-6. What in your opinion has been most responsible for your present condition? (Use this space.)

III-7. On a scale from 0-10, indicate your present
ability to relax:

No relaxation ______ Very deep

00 01 02 03 04 05 06 07 08 09 10 relaxation

III-8. At the present time, how are you generally different from when you had biofeedback/relaxation?

( ) No different ( ) I am generally better

( ) I am generally worse
Appendix I--Continued

III-9. How is your life situation different now? For example, has there been a birth, a death, a marriage, a divorce, a job or living change? Do you consider things better or worse? (Use this space to describe.)

III-10. Use the remaining space here and on the attached sheet of this form to make any comments you would like or you feel might be helpful in determining the last effects of biofeedback/relaxation for your condition.

THANK YOU FOR YOUR PARTICIPATION

Note: Parts I-III taken from clinical biofeedback: A Procedural Manual (Gaarder & Montgomery, 1977)

PART IV

IV-1A. At the end of this program, what amount of improvement in your acne condition have you noticed?

( ) None ( ) Small ( ) Large ( ) Very small

( ) Moderate ( ) Very large

IV-1B. What percentage of this improvement do you attribute to the biofeedback-assisted stress-management procedures that you employed? Fill in a percentage from 1-100%: ________%
IV-2. In your opinion, could you have achieved equally 
good results from home practice and only one 
biofeedback office visit/week? ( ) Yes ( ) No

IV-3. Do you have medical insurance that covers visits to 
Acne Health Care Center?
( ) Yes ( ) No

IV-4A. Pending final data analysis, this program will be 
made available to all patients at our clinics.
Individual biofeedback training sessions, conducted 
by a Ph.D. psychologist, will cost $40 per session.
The number of individual training sessions will no 
longer be fixed. Instead, the number of sessions 
will vary from patient to patient, depending upon 
their individual needs and rate of progress. Would 
you recommend this program to other acne patients?
( ) Yes ( ) No

IV-4B. Why or why not? Explain on back of page.

IV-5. If needed, would you return for a "refresher" 
biofeedback-assisted stress management training 
session(s)? ( ) Yes ( ) No

IV-6. Use the back of these pages to make additional comments 
or explanations.

THANK YOU, AGAIN!
Appendix J

This is a tape that will help you understand your health and your disease process a little better. What I try to do is explain to you how your body works and how you can help it repair itself easily and quickly. So let's begin.

I would like for you to just take a very comfortable position in your chair or bed, let your arms relax and your legs relax and your neck relax. Just focus on a place on the wall, take some very deep breaths and again concentrate on relaxing. Just concentrate on that place on the wall until your eyes become very heavy. And as they become very heavy, just let them close. Just let them become very heavy and close. (PAUSE) Very good.

Now I would like for you to become very aware of your breathing. (PAUSE) Breathe in very deeply and breathe out very deeply. Breathing is very important to your health. (PAUSE) Breathing in brings in the rich oxygen; breathing out is getting rid of the toxins and poisons that's been building up in your body. So it's very important to breathe very deeply. So I would like for you to become very aware of how you breathe. (PAUSE) Keep in mind breathing in the rich oxygen; breathing out the poisons. (PAUSE) The deeper that you breathe the more poisons you're getting rid of. This
helps your body to repair itself more easily.

(PAUSE) So just become aware, become aware of your breathing. (PAUSE)

Now, I would like for you to think about or imagine yourself in an elevator. You're in an elevator and you're going down. And as you're going down, you're becoming more and more aware of your own self. You're becoming more and more aware of your self and your body and the insides of your body. So as I count down from ten, think of yourself as becoming more and more relaxed. Ten, nine, eight, seven . . . . becoming more relaxed, becoming more at calm with yourself, six, five, four . . . . very relaxed; keep breathing three, two, one . . . . very relaxed.

Now, I would like for you to take a journey through your body and help your body relax even more. I would like for you to concentrate on your feet, make them as relaxed as possible; tell your muscles in your toes, tell the muscles in your ankles to relax; there's no place to go and they can just relax. (PAUSE) Tell your calf muscles to just relax. Just to become very warm, very comfortable, that they can relax now. (PAUSE)

Now, I would like for you to tell your upper legs, the muscles in your upper legs and your thighs
and in your hips, tell them to relax. Just let the blood vessels open, dilate, the blood warm up your entire legs. Just let the blood warm up in your legs, keep breathing very, very deeply. Because as you're breathing deeply, this helps the blood gain more oxygen. And the more oxygen you have the richer it is, the more nutritious it is for your muscles. So breathe very deeply, relax your muscles, let your blood flow very freely.

Now at the count of three, I would like for you to let your legs be twice as relaxed as they are now. One, two, very deeply, three. Very good. Now let that feeling of relaxation rise up in your body into your stomach, into your chest. Continue to breathe very deeply. (PAUSE) Let the warmth spread throughout your body, to your shoulders. (PAUSE) Your arms, your hands and your fingers, to the very tips of your fingers, (PAUSE) with each little muscle being bathed in rich nutritious blood, enriched by oxygen as you breathe in. (PAUSE) As you are breathing very deeply, becoming very relaxed, I would like to explain some things about acne, about why people have acne and how you can help yourself rid yourself of some of the blemishes. First of all, I would like to explain to you what acne is. Over your face are little glands; these are called
sebaceous glands. These glands excrete liquids that is usually used for the cooling of the body, the bathing of the body and moisturizing of the skin. These are usually very good for you. These glands called sebaceous glands excrete liquid that is called karatin. Karatin again is a normal liquid, however, when you're stressed this creates an overactivity of this karatin type liquid. It causes it to glue cells together. This causes a blockage in the pores in the skin so that then you are very tense, so that when you are stressed these pores get blocked up with this karatin substance. When you're relaxed, when you're breathing easily, when you don't have worries on your mind, the karatin does not block the pores. Consequently, your whole face breathes more easily; lets the sebaceous glands flow very easily. Consequently, there are no pimples; there are no blockages. So what you can do for yourself is to become more relaxed. Concentrate on being relaxed several times a day. So I would like for you to concentrate on relaxing your face, relaxing each pore, letting it become more free, letting it free itself. Let it let go of the karatin, of the other kinds of nutritious juices that bathe your face. So now, while you are relaxed, while you are in the situation that is most helpful for you, I would
like for you to go in your mind's eye, over each part of your face. Concentrate on each part of your face, concentrate on each pore and relax that pore. Relax the opening to that sebaceous gland and let it flow like it should. I'll give you a moment or two just to go through each part of your face, in your mind's eye, and relax that pore that you're concentrating on. Remember to breathe very deeply. Remember to continue to be as relaxed and just let your body do what it should. (PAUSE) Remember while you are relaxed and concentrating on one pore, perhaps you could say to it "Relax, relax, accept yourself, because you are free, to relax and be free to be yourself." I would like for you to talk to each pore in your face. Go ahead, I'll be with you in a moment. (PAUSE) I would like to remind you to continue to breathe very deeply. As you breathe in very deeply, let your face become warm, let your face become healthy with its own relaxation. With its own natural health. (PAUSE) Take the tension out of your face. (PAUSE) That's very good. That's very good. You need to continue to breathe very deeply. I would like for you to concentrate on what you saw in your face. I would like to review what you could have imagined. You could have imagined your glands inside your skin becoming more relaxed.
You could have imagined the tension in your face being more relaxed and your skin becoming more healthy, more content with itself. I would like for you to think about what you have just experienced. You have done a great service to your body, a great service to your skin. So as you become more and more alert, more and more aware of your surroundings you should begin to open your eyes. You should pat yourself on your back because you have done a very good thing for your body and for yourself. Have a good day.
Appendix K

Introduction to the Electromyograph

The equipment that you see here is an electromyograph. It will be used to detect muscle-produced electrical activity in your forehead muscle group. The equipment is designed so that electrical activity that your body produces can travel from electrodes that are placed on your forehead to the apparatus. It is designed with safety features to prevent the possibility that you could receive an electric shock. You will in no way experience anything that is harmful.
Appendix L

Steps for Creating Your Own Happiness

Step 1: Decide if the kit is right for you.

Step 2: Learn three facts about happiness.

Step 3: Decide if your happiness is worth the time you waste.

Step 4: Give yourself happiness insights by:
   (a) Listening to side one of the prerecorded cassette, *Give Yourself A Happier Day*
   (b) Recording in your own voice, on side two, *Today I Will Give Myself A Happier Day*.

Step 5: Learn the facts about helping yourself to happiness by reading from the text daily.

Step 6: Review your happiness insights daily by giving yourself two tape listening sessions daily (side one at bedtime and side two upon awakening in the morning).

Step 7: Take the fastest road to rapid self-help by re-reading chapters of the text.

Step 8: Prove your brain is your best tranquilizer by doing a written Rational Self-Analysis weekly.
Appendix M

Acne Severity Grades at 2-Week Intervals

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