Applied Psychophysiology: A Bridge Between the Biomedical Model and the Biopsychosocial Model in Family Medicine

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Over half of all patient visits to primary care physicians are related to psychosocial problems that are presented as common somatic complaints. It appears that psychophysiological diagnostic and therapeutic methods can directly, objectively, and quantitatively reveal this missing mind–body connection. Psychophysiological methods, including biofeedback, hypnosis, and cognitive behavior therapy, have been shown to be empirically effective with several somatic conditions even though the specific mechanisms of efficacy of these therapies have not been identified. The classification, diagnosis, prevention, and therapy of stress-related disease and somatization disorder require a psychophysiological approach and can most effectively be conducted in a nonpsychiatric primary care setting.

As many as 75% of all patient visits in primary care practice can be attributed to psychosocial problems that present through physical complaints (Roberts, 1994). Family physician researchers have identified somatization disorder as the fourth most common diagnosis encountered in primary care, placing it ahead of ischemic heart disease, diabetes mellitus, obesity, urinary tract infections, and otitis media (DeGruy, Columbia, & Dickenson, 1987). Forty percent of all patients in a typical family practice have somatoform disorder (Smith, Miller, & Monson, 1986). At least 50% of all morbidity and mortality that physicians encounter can be traced to behavioral origins (McGinnis & Foege, 1993); consequently, chronic illness is the nation’s overwhelming health problem. Efforts at preventing this burden of illness would be maximized by a collaboration between psychology and medicine to manage the behavioral origins of disease.

Despite the efforts of family medicine to work in this direction, modern-day biomedicine continues to deal least effectively with psychological causes, consequences, and states of illness. Family medicine has preached and demonstrated a strong commitment to the biopsychosocial model (Engel, 1977), but in practice most behavioral medicine is found within the context of medical student teaching and residency training programs. In the real world of clinical practice, it is difficult to determine how much (or how effectively) the biopsychosocial approach influences the typical family physician’s daily work. Much emphasis has been placed on the family context of illness and the use of family system theory (Bowen, 1966). The incorporation of family therapy into the family practice clinical model (Doherty & Baird, 1983) has become a documented approach. Clinical psychologists and other nonpsychiatric mental health professionals can be found on the teaching faculties of virtually all family practice educational training programs, and the potential for increased clinical collaboration between the two fields is great. Indeed, the Society of Teachers of Family Medicine represents an interdisciplinary forum for family physicians and behavioral science health professionals, with some 25% of its 2,000 or more members being nonphysicians.

The purpose of this article is to identify the applied psychophysiological approach as a meeting place for mental health and family medicine to address a large percentage of primary care...
clinical practice. The clinical efficacy and cost-effectiveness of biofeedback therapy has now been credibly established (Amar & Schneider, 1995; Schellenberger, Amar, Schneider, & Turner, 1994). Research detailed in the articles appearing in this special section adds to the evidence already documented concerning the extensive clinical applications and cost-effectiveness of biofeedback and applied psychophysiology for specific chronic somatic symptoms. The advantages of the applied psychophysiological approach and biofeedback as a means of achieving relatively rapid control of symptoms in selected patients can be particularly useful in adding credibility to the biopsychosocial model in the teaching context.

Applied Psychophysiology and Family Medicine

Applied psychophysiology "provides a bridge from the biomedical model, in which the patient is a passive recipient of services to the biopsychosocial model" (Engel, 1977) in which the patient is an active participant" (Wickramasekera, 1989, p. 536). Biofeedback began with basic research that demonstrated the ability to operate and condition the responses of the autonomic nervous system. Applied psychophysiology and biofeedback have evolved into the scientific study of the interrelationships of physiologic and psychologic (cognitive and emotional) processes for diagnostic and therapeutic goals in patients. Its emergence as a discipline has encompassed fields ranging from hypnosis and behavioral medicine to cybernetics and biomedical engineering (Schwartz & Associates, 1987; Wickramasekera, 1976, 1988).

As a clinical method of applied psychophysiology, biofeedback continues to be understood in primary care even though its empirical efficacy for certain common chronic disorders has been scientifically validated as an adjunctive or primary therapeutic modality (Gatchel & Blanchard, 1993; Hatch, Fisher, & Rugh, 1987). In practice, biofeedback and other empirically validated psychosocial methods, like hypnosis (Rhue, Lynn, & Kirsch, 1993) and cognitive behavior therapy (Chambless, 1995), can enable patients to reduce symptoms and change maladaptive behaviors. With modern-day technology, physiologic feedback can include muscle activity, cardiac activity, blood pressure, peripheral blood flow, sweat gland activity, and brain electrical activity. Biofeedback, behavior therapy, and hypnosis have some common features (Wickramasekera, 1976) that may make them the treatments of choice for functional headaches, irritable bowel syndrome, Raynaud's disease, and fecal and urinary incontinence. However, the specific mechanisms of efficacy for these technologies are still unclear (Cohen, Graham, Fotopoulos, & Cook, 1977; Strobel & Glueck, 1973; Taub & School, 1978; Wickramasekera, 1977, 1980, 1985). Future empirical studies will specify the multifactorial mechanisms of efficacy in psychophysiological and cognitive-behavioral techniques for somatic symptoms (Gatchel & Blanchard, 1993; Wickramasekera, 1988). The empirical potency of nonspecific or placebo effects in medicine and surgery is well established (Roberts, Kewman, Mercier, & Howell, 1993; White, Tursky, & Schwartz, 1985). Strobel and Glueck (1973) and Wickramasekera (1971, 1973, 1976) found that biofeedback can amplify the placebo response, and this view has some empirical support (Cohen et al., 1977; Kewman & Roberts, 1980; Taub & School, 1978). The effort "to explicitly specify the active mechanisms and the parameters of the placebo response" (Wickramasekera, 1980, pp. 6-7) continues. It appears today that a Pavlovian conditioning theory of the placebo response (Ader, Weinert, & Baum, 1988; Wickramasekera, 1977, 1980, 1985) best accounts for the empirical data (Ader, 1989, in press; Ollens & Ader, 1992; Voudouris, Peck, & Coleman, 1985, 1989, 1990), but only the operant conditioning component has been systematically examined in most biofeedback studies.

Ever since its inception during the late 1960s as the 20th medical specialty, family medicine has been searching for the effective clinical expression of its commitment to behavioral medicine. More than a decade ago, Thomas L. Schwenk called for the creation of "a high technology of behavioral science," using high technology as a metaphor for intellectual elegance (Schwenk, 1982, p. 19). Fortuitously, modern-day reality has married the two together in the form of applied psychophysiology and biofeedback. The integration of applied psychophysiology within family practice would represent a natural alliance with which to approach that so-called difficult 40% of all patients in family practice who have somatoform disorders (Smith et al., 1986). Somatizers are notoriously skeptical of, and resistant to, psychological referral (Arean & Miranda, 1993; Bass & Benjamin, 1993; DeGoede, 1983; Smith, 1990). Hence, the Trojan horse and other cognitive-social role inductions (Wickramasekera, 1976, 1988, 1989) were designed to erode this skepticism and to potentiate their response to verbal instructions. The Trojan horse role induction is started in the initial interview with physiological monitoring (heart rate, blood pressure, electromyogram [EMG; muscle tension], skin conductance, and so forth) of the patient's own body in a psychophysiology laboratory. The Trojan horse procedure is a voluntary clinical demonstration of how reliably and immediately therapist-induced cognitive stress (mental arithmetic) will alter a variety of the patient's own vital functions. This particular cognitive stress demonstration can be used with skeptical patients of low or moderate hypnotic ability. Skeptical patients of high hypnotic ability can be given suggestions for hypnotic analgesia or catalepsy (but always in a part of their body distant from the location of their symptoms) to show them how immediately and reliably their own perception of acute pain or their motor functions can be cognitively altered. High hypnotic ability in a patient can be primed, but reliably and quickly (less than 10 min), identified with clinical judgment and a score above 85% on the Absorption Scale (Glikson, Tataryn, Tobias, & Kihlstrom, 1991; Tellegen & Atkinson, 1974; Wickramasekera, 1993; Wickramasekera & Atkinson, 1993). These early demonstrations can amplify the patient's attention, build an alliance against some symptoms, and begin to erode skepticism about the mind-body connection. This role induction also appears to reduce the dropout rate after the first interview (Wickramasekera, 1988). These and other components of the Trojan horse role induction provide access to the somatizer's curiosity through changes cognitively induced in the somatizer's own body. Direct access through reason and logic is frequently an exercise in futility. The demonstration of changing physiologic
measurements in response to psychologic intervention amplifies the credibility of psychological referral for both the primary care physician as well as the somatizing patient. The stigma of mental illness in the medical sector (DeGoede, 1983) inflates the "psychological distance" between the primary care physician's office and the psychologist's office from "several miles to several light years" (Wickramasekera, 1989, p. 536). By locating the psychophysiological diagnostic and therapy unit within the primary care center, this inflation is avoided and somatizers can learn to substitute psychophysiological skills (biofeedback, self-hypnosis, cognitive self-monitoring, and so forth) for the pills that control symptoms. Finally—and at this developmental stage, perhaps most importantly—family medicine, clinical providers, and trainees will have the opportunity to witness the effectiveness of the psychophysiological method firsthand and within the mainstream of their primary care clinical practice.

Case Presentation

As an example of the collaborative approach between a family physician and a clinical psychologist, the following case describes dramatic improvement in a patient who was diagnosed by Terence E. Davies, her family physician, as suffering from psychophysiological based somatization. She was subsequently referred for psychophysiological psychotherapy (PPP) to Ian Wickramasekera. The proximity of family medicine to the psychophysiology laboratory, which is located outside the Department of Psychiatry, and the close working relationship between the referring primary care physician and the psychologist reduced the psychological distance that this patient had to travel to get help for her somatic symptoms. In our experience, this case of a patient with multiple allergic and somatic problems is not unique, and it illustrates that successful therapeutic outcomes with difficult patients can occur when applied psychophysiology is integrated within primary care practice.

Susan is a 43-year-old White mother of two children with presenting complaints of "severe respiratory allergies" since the age of 6 as well as "sinus infections" and "chronic headaches for over 15 years." She had managed her allergies since childhood with nonprescription preparations but began taking Seldane 7 years ago. She reported that "stress" related to her husband and her job may amplify her "sinus infections." She had just completed one and a half years of desensitization for multiple allergies. Her allergist told her that she had the "worst allergies he had ever encountered." Her referring primary care physician described her as a "selfless worker." Her headaches had necessitated the "regular use of analgesics including Darvocet." Davies referred the patient to Wickramasekera after witnessing a potentially life-threatening "classic anaphylactic reaction" following her most recent allergen injection into which she developed "hives in waves from head to toe."

On her initial interview, Susan was pleasant and cooperative, and there was no evidence of any Diagnostic and Statistical Manual of Mental Disorders (3rd ed., rev.; American Psychiatric Association, 1987) diagnosable psychopathology beyond the report of a lack of self-assertion with her husband and moderate job stress. The patient was evaluated for PPP, which is essentially psychotherapy guided by physiological monitoring for unconscious threat perception with adjunctive hypnotherapy, biofeedback, or both (Wickramasekera, 1988). Susan was told that we needed to evaluate her for PPP by determining her status on certain specific high-risk factors: high or low hypnotic ability, high overt or covert neuroticism, high catastrophizing, major life change, multiple hassles, low support systems, and low coping skills.

The high risk model of threat perception (HRMTP) provides nine quantitative psychophysiological risk factors that appear to amplify or reduce autonomic dysregulation, promote somatization, and may eventually contribute to pathophysiology\(^1\) (Wickramasekera, 1976, 1979, 1984, 1986, 1988, 1995; Wickramasekera & Atkinson, 1993). Three of these risk factors are hypothesized to block threat perception from consciousness: high or low hypnotic ability (Wickramasekera, 1979, 1988) and high covert neuroticism or "repression" (Weinberger, 1990). They are hypothesized to be psychological mechanisms that can increase the risk of incongruity (discrepancy) between subjective perception (consciousness of threat) and physiological or behavioral markers of threat perception. In other words, these three risk factors can block threats from reaching consciousness, causing autonomic dysregulation (Wickramasekera, 1976, 1988).

On the other hand, the following risk factors (Wickramasekera, 1979, 1988) are hypothesized to amplify the perception of threat: high hypnotic ability, high neuroticism or negative affectivity (Watson & Clark, 1984), major life changes (Holmes, 1981), multiple hassles (Kanner, Coyne, Schaefer, & Lazarus, 1981), low support systems (House, Landis, & Umberson, 1988), and low coping skills (Lazarus & Folkman, 1984). Incidentally, hypnotic ability is statistically unrelated (orthogonal) to all the above risk factors including high (17+) Marlowe-Crowne (Crowne & Marlowe, 1960) scores that are used to index high covert neuroticism (Wickramasekera, 1988, 1993, 1995). Paradoxically, high hypnotic ability, depending on how it is used, can both reduce (block as in hypnotic analgesia or posthypnotic amnesia) or amplify (as in phobias or pain perception) the perception of threat.

There are three hypothesized features of high hypnotic ability people that place them at risk for somatization: (a) their propensity to perceive involuntariness (lack of self-control) in perception, memory, and mood both within and outside of hypnosis during threat—this perception of events occurring by themselves can spiral fear and depression; (b) surplus empathy (poor interpersonal boundaries); and (c) surplus pattern recognition, or the tendency to see meaning in events that are randomly distributed (Wickramasekera, 1979, 1988, 1995). These nine risk factors can be divided into predisposers: high or low hypnotic; high overt or covert neuroticism; high catastrophizing; triggers, including major life change and multiple hassles; and buffers, including a high number or satisfaction with social support and high coping skills. It is important to note that hypnotic ability is unrelated (orthogonal) to neuroticism (Barber, 1969; Hilgard, 1965). It appears that both hypnotic ability (Morgan, 1973) and neuroticism (Tellegen et al., 1988) are stable and partly geneti-

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1 The therapist is an ABPP diplomate in clinical psychology and professor of psychiatry and behavioral science.

2 This position is consistent with the view that some of these patients are found to have pathophysiology.
Figure 1. Psychophysiological Stress Profile pretherapy and posttherapy. Mean changes in skin conductance, hand temperature, finger blood volume pulse, heart rate, and forehead muscle tension. The height of each bar is equal to the mean of 15 data points collected over 1 min. There are eight means (i.e., 8 min) prior to the stress period, four means (i.e., 4 min) during the stress period, and eight means (i.e., 8 min) during recovery from the stress period. Each prestress and poststress period is composed of 4 min of eyes open and 4 min of eyes closed recording. A total of 300 data points were collected on each physiological measure during the 20 min of recording time.
Heart Rate

Forehead Muscle Tension

Figure 1. (continued)

cally based traits that probably exist premorbidly. Catastrophiz-
ing is a learned cognitive behavior that can be reduced with cog-
nitive behavioral therapy techniques (Wickramasekera, 1976, 1988). It is hypothesized that the interaction of hypnotic ability with high overt or high covert neuroticism (negative affectivity) drives the bulk of symptoms. Also, it is hypothesized that these nine risk factors are the essential and sufficient conditions to ex-
plain, predict, and control all human psychophysiological in-
teractions. The clinical use of this complex model is described elsewhere (Wickramasekera, 1988, 1993).

Susan was told that her acceptance for therapy would be based on her up-front demonstration of her commitment to learning psychophysiological self-soothing skills and her willingness later to investigate the deeper antecedents and consequences of her somatic symptoms. She was told that "We would first put out the symptomatic fire with skills and later look for the matches." She could prove her commitment to being an ac-
tive participant in her therapy by reliably and accurately collect-
ing data on the frequency and intensity of her symptoms, their antecedents, and their consequences at the following times: be-
fore therapy (baseline), during therapy, and at follow-ups (6 months, 12 months, and 5 years). She signed a written contract agreeing to the testing, data collection, and long-term follow up.

Testing on the psychological part of the HRMTP revealed that Susan had only two of nine risk factors for somatization. However, those two factors were two of the three most potent mechanisms for blocking the perception of threat (negative affect) from consciousness and appeared relevant to the psycho-
dynamics of this case. These two risk factors were high hypnotic ability (Harvard Group Scale of Hypnotic Ability [Shor & Orne, 1962] score 9 of 12) and high covert neuroticism or high repression (Weinberger, 1990). Repression was operationally defined as a low (below 25%) neuroticism score on the Eysenck Personality Inventory (Eysenck & Eysenck, 1968) and a high (23) Marlowe Crowne score (Crowne & Marlowe, 1960). Sus-
an's high hypnotic ability indicated that she could block threats from consciousness (Wickramasekera, 1979, 1988, 1993; Wickramasekera & Atkinson, 1993). Her high repression
score (Weinberger, 1990) also indicated an ability to block the
perception of threat from consciousness. Hence, she had two
statistically unrelated or orthogonal (Palsson, 1992; Remler,
1990; Wickramasekera, 1979, 1988) cognitive mechanisms—
high hypnotic ability and high repression—to block the percep-
tion of threat or trauma from consciousness or explicit verbal
report. The observation of two potent blocking mechanisms is
infrequent and is always clinically associated with serious dis-
ruptive somatic symptoms (Wickramasekera, 1994b). These
potent cognitive blocking mechanisms may account for why all
of Susan’s prior clinical interviews and verbal report psychol-
ogical tests, like the Neurorsitic, Extraversion, Openness Inven-
tory (NEO; Costa & McCrae, 1989) and the Symptom Check-
list-90 (Derogatis, 1990), were free of psychopathology, pro-
ducing an “illusion of mental health” (Shedler, Mayman, &
Manis, 1993, p. 1117). However, distress or negative affect
(Watson & Tellegen, 1985) that is repressed from consciousness
is not necessarily abolished from the body. Susan’s suffering
was out of mind but not out of her body (Wickramasekera, 1979,
kinson, 1993).

On the Psychophysiological Stress Profile (PSP; Wickrama-
sekera, 1976, 1988, 1993) component of the HRMTP, there
were several physiological indications of distress not present in
the prior conscious verbal report tests. The PSP was done in
a temperature-controlled and electrically shielded room follow-
ing all standard procedures (Andreassi, 1989) for psychophys-
iological recording. It is important to present pre- and posttest-
ing on the PSP because it provides independent biological
support for the two psychological risk factors, and it provides some
support for the view that therapy did not simply reduce this
patient’s symptoms but may have also altered autonomic bal-
ance (Wenger, 1972). Autonomic balance is hypothesized to be
implicated in the etiology of somatization (Wickramasekera,
1988). The results of Susan’s PSP are given in Figure 1. In that
figure, the height of each of the 20 vertical bars on the PSP is
the mean of 15 data points. There were five periods as follows:
(a) 4 min of Eyes Open 1 and (b) 4 min of Eyes Closed 1 re-
cording before (c) stress. Stress was 4 min of standardized men-
tal arithmetic, which was followed by a recovery or resting base-
line period of (d) 4 min of Eyes Open 2 and (e) 4 min of Eyes
Closed 2. Means, standard deviations, and ranges were com-
puted for each of these five periods. Figure 1 shows pretherapy
(January 14, 1993) and posttherapy (August 22, 1993) means
for the following: left-hand skin conductance, left-hand skin
temperature, blood volume pulse (BVP), heart rate, and fore-
head muscle tension (EMG) on the PSP. Clear changes in these
five physiological measures from pre- to posttherapy are indi-
cated by changes in the heights of the bars in Figure 1. They
illustrate a significant drop across at least three physiological
measures (skin conductance, BVP, and temperature) of threat
perception associated with therapy. More importantly, one may
even infer positive changes in the general psychophysiological
mechanism of autonomic balance (Andreassi, 1989; Wenger,
1972) associated with threat perception or negative affect. Be-
cause therapy was conducted in a consulting room outside the
testing laboratory, adaptation to the laboratory is unlikely to
explain these physiological changes.

Susan’s mean baseline hand temperature was 79.76°F (SD = 
.57), which is approximately 7 degrees colder than a patient
matched (age, sex, time of year, and so forth) control group
(Blanchard, Morrill, Wittrock, Scharff, & Jaccard, 1989). She
reported that her hands and feet were “always cold and wet.”
When asked during baseline testing to close her eyes and relax,
her hand temperature actually dropped, whereas normally it
would be expected to increase. This drop in hand temperature
was correlated with intrusive aversive thoughts and feelings the
patient reported coming into her mind when she closed her eyes
and tried to relax. The PSP cognitive stress period generated a
paradoxical temperature increase (PTI) in Susan’s hand tem-
perature. This increase was clearly documented also in a para-
doxical increase in BVP during the stress period. Others
(Barlow & Cerny, 1988; Cooke, Creager, Osmundson, & She-
pherd, 1990; Wickramasekera, 1988; Wickramasekera & Atkin-
on, 1993) have observed this PTI response in patients with
chronic stress-related disorders such as chronic pain, Ray-
naud’s disease, and panic disorder. It appears consistent with a
learned dissociative coping type of relaxation response during
stress. Some of these patients report cognitively escaping during
stress and reacting to stress only after the fact. Susan reported
being “strong during a crisis,” but said she becomes sick only
after the crisis. In fact, during the PSP, she demonstrated a de-
layed response to and delayed recovery from the cognitive stres-
sor with a drop in temperature and BVP below her prestress
baseline. Before therapy, her prestress baseline skin conduc-
tance (EDR) was 17.72 μmho (SD = 1.33 μmho). EDR has
been shown to be exclusively sympathetically innervated, un-
like heart rate which is both sympathetically and parasympa-
ethetically innervated (Boucein, 1992). This means it is a so-
called pure measure of sympathetic activation (fight and flight
response). Susan’s EDR was several times higher than the mean
resting baseline for nonpatient women her age. During the base-
line relaxation period, her EDR actually increased when she
closed her eyes and tried to relax. This increase again suggests
the intrusion of aversive cognitions or emotions when she closes
her eyes and attempts to relax. Note that this response was aboli-
shed after therapy. Prior to therapy, during cognitive stress, her
mean EDR climbed to 24.63 μmho (SD = 1.26 μmho); poststress
it actually continued to escalate for 8 min to a mean of 27.27 μmho
(SD = .62 μmho). This suggested strong sympa-
thetic activation (fight or flight response) and delayed recovery
from even brief cognitive stress before but not after therapy.
Susan’s pretherapy EMG or muscle tension (M = 11.21 μvols;
SD = 1.4 μvols) and her heart rate showed a normal baseline
(M = 77.69 beats/min; SD = 2.44 beats/min), only normal reac-
tivity to cognitive stress (M = 86.27 beats/min; SD = 4.16
beats/min), and a rapid heart rate recovery (M = 68.84 beats/
min; SD = 3.60 beats/min). Hence, from a conventional vital
signs measure (heart rate) or frontal muscle tension measure
(EMG), there is no evidence of any stress syndrome!

This finding illustrates the importance of individual differ-
ences in even physiological measures of reaction to the same
cognitive stressor (mental arithmetic) or the psychophysologi-
cal principle of individual response specificity (Lacey, Bate-
man, & Van Lehn, 1953). It also suggests that once a person’s
stable window or windows of vulnerability (most reactive re-
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Response systems) have been identified with the PSP, physiological monitoring during psychotherapy can be limited to one or two response systems. In this case, skin conductance and temperature were more reactive and most useful psychologically.

It is worth noting that on a clinical interview, on conventional psychological testing (SCL-90, NEO), and even on two conventional physiological measures (i.e., heart rate and muscle tension), Susan demonstrated normality! However, testing on the HRMTP, which is specifically designed to study somatization, provided evidence of significant mind–body disorganization. Her implicit or unconscious suffering was clearly evidenced in her body by her cold and wet hands and by her multiple chronic somatic symptoms.

The patient was confronted with the pretherapy test findings and was told that testing had revealed two unrelated cognitive mechanisms (Palsson, 1992; Remler, 1990; Wickramasekera, 1979, 1995) that enabled her to keep secrets from herself but not from her body. Her clinical symptoms were probably information about her unconscious distress. This mentally repressed distress may have compromised her immune system, thereby producing her somatic symptoms (Jensen, 1987; O'Leary, 1990). Within the therapeutic alliance, she learned self-hypnosis and temperature biofeedback skills to temporarily self-soothe her body and mind. As she acquired an ability to physiologically self-soothe and to be less fearful, the previously unconscious, metaphorical dragons that were driving her body's red alert status stepped into consciousness. As she identified her dragons and learned to deal with them more effectively, she learned not only how to put out her symptomatic fires, but also how to locate and diffuse the matches.

Figure 2 shows Susan's skin temperature (left hand) before and after practice of self-hypnosis over 11 sessions. Because of her high hypnotic ability, she was able to acquire mastery of the hand warming skill in 4 sessions (see Figure 3), and in her low arousal state, she gained access and insight into first her irritability and later her rage at her husband. Several suppressed or repressed traumatic marital incidents that cannot be reported here emerged into consciousness. These incidents were independently documented by public records and her employer. The patient's husband had total control of several significant areas of her life. For example, he controlled her paycheck, any money she spent, and their social life. When they were first married, because he was older than she and she "adored him" and always accepted his guidance, she still had to serve him "hand and foot," and he "did nothing" for her personally. He treated her like "a child at times," and at other times he treated her as if she was "his mother." There had been little or no intimacy between them for many years. The patient was surprised at how angry she was at her husband and how she had denied and buried her rage at him for many years. She recognized that she had some boundary problems driven by her surplus empathy that disrupted self-assertion. In the course of therapy, the patient became more self-assertive at home and work. As her rage at her husband surfaced, she became very depressed about her marital situation. As this strong negative affect came to consciousness, her headache pain reduced (see Figure 3). Susan had no headaches from Week 13–18 and has had few headaches in the last 24 months. Cognitive behavioral therapy was used to treat her depression and to encourage her self-care. She began to allocate more of her time and money to self-care. She became less concerned about the disapproval of her husband and coworkers. Both her allergic reactions to multiple foods and environmental substances and her pain reports were reduced in spite of the withdrawal of all allergic and analgesic medications. She stated at the 24-month follow-up, "I am eating foods (potatoes, hot dogs, crab meat, dairy products, green beans, peas, oatmeal) I could not eat before." Her husband was unwilling to participate in marital therapy despite numerous efforts to directly or indirectly draw him into marital therapy, even as a consultant on her physical or mental problems. The patient was told up-front that therapy might destabilize the marriage, but she chose to continue in therapy. Her husband persisted in viewing the problem as solely his wife's physical disease.

Posttesting (August 22, 1993) on the HRMTP at 7-month follow-up indicated, as previously noted, very significant improvement on Susan's PSP (see Figure 1) but only a modest change in her psychological status. Three physiological measures indicated that her body perceived less threat, but psychological measures indicated that her mind perceived more threat. Her hypnoticism increased (pretest = 48%; posttest = 69%), and her Marlowe Crowne score dropped (pretest = 23; posttest = 10). Susan is now aware of mental distress but has less somatic distress. The drop in the Marlowe Crowne score may indicate a less effective repressive mechanism. Her hypnotic ability is the same but is probably reversed in its direction of activity. Susan appeared to have learned (a) to use her hypnotic ability more adaptively to identify rather than block subtle threats and (b) to use self-hypnosis to self-soothe and recover more rapidly when she is agitated. At termination of her once-per-week 3-month therapy, she rated her allergies as 90% improved; on long-term follow-up (24 months), she reported 100% remission of all allergies and somatic symptoms, increased self-confidence, and sustained high self-assertion. However, under further serious stress, the marriage may require professional attention.

Discussion

This case illustrates some key issues. First, this patient presented with a classical clinical syndrome that had been treated vigorously with a variety of pharmacologic therapies. A biomedical diagnosis triggered a reductionistic management approach. Second, the true nature of the condition became apparent only when the patient was confronted with the results of psychophysiological testing. However, once that understanding had been gained, she responded rapidly to a psychophysiological treatment plan. Third, following the failure of conventional biomedical therapies, psychophysiological treatment outcome benefits were impressive and lasting (24 months). The patient's development of insight into her own mind–body interaction made her an enthusiastic advocate of the method.

Schwenk (1982) stated, "The research necessary [to create a high technology of behavioral science] may include other disciplines, but the family physician who assumes clinical responsibility for the afflicted patient should also assume responsibility for the appropriate research" (pp. 19–20). The case
Sessions of practice

Figure 2. Patients' peripheral skin temperature before and after daily self-hypnosis.

A study outlined in the previous section is very relevant to "the appropriate research." First, by the available psychiatric diagnostic criteria and some conventional psychological tests (Shedler et al., 1993), the patient, like many patients seen in primary care, was without any diagnosable psychopathology in terms of depression, anxiety, or the criteria for somatization disorder. The need for a new taxonomy for somatization seen in primary care has been discussed (McWhinney, 1972; Sheff, Rand, Paterson, Ellis, & Weeks, 1994). Hence, diagnostic criteria and tests specialized for detecting repression and the conversion of negative affect (Watson & Tellegen, 1985) into somatic symptoms may need to be developed for use in primary care and medical settings. The HRMDT provides one set of specific, quantitative, empirically supported risk factors (Wickramasekera, 1979, 1988, 1993, 1995) that can be tested concurrently with the investigation of pathophysiological mechanisms in patients presenting somatic symptoms in primary care. This provides an opportunity to diagnose somatization by the inclusion, and not merely by the irrational exclusion, of pathophysiology (Wickramasekera, 1986, 1988, 1995). Risk factor assessment can contribute a specific direction to therapy (risk factor reduction) as in the above case study and may contribute to differential diagnosis in a cost-effective manner. In this form of therapy, the somatizer learns skills to not only put out the fires of somatic symptoms, but also to find the matches. It is hypothesized that unless the unconscious antecedents and consequences of somatizations are defused, the fire will start up in another organ system (Wickramasekera, 1988). The empirical efficacy of a psychophysiological approach to several somatic symptoms has been documented (Gatchel & Blanchard, 1993; Hatch et al., 1987) and is documented in the special section of this journal. However, controlled empirical studies have largely demonstrated only symptom reduction and have not begun to address the conscious, or more likely unconscious, antecedent and consequent mechanisms that drive and sustain these chronic somatic symptoms (Wickramasekera, 1979, 1988, 1995). Future clinical research will address both clinical symptoms and the hypothesized etiologic mechanisms (e.g., risk factors) that drive the clinical symptoms, as illustrated by the aforementioned case study.

In some cases, sensitive, quantitative, psychophysiological monitoring may be another royal road to the unconscious, that is, to the perceptions, memories, and moods that drive the multifactorial (genetic & conditioning histories) etiology of somatization (Wickramasekera, 1988, 1991, 1993, 1994a, 1994b; Wickramasekera & Atkinson, 1993). The psychophysiological changes associated with chronic activation of overt or covert negative affect can—through neuroendocrine and immune mechanisms—contribute to and sustain not only psychopathology but also pathophysiology (Cohen, Tyrrell, & Smith, 1991;
Herbert & Cohen, 1993; Kiecolt-Glaser et al., 1993; O’Leary, 1990; Yehuda, Resnick, Kahana, & Giller, 1993). Cohen et al. (1991) showed a dose-response relationship between overt negative affect and both (a) virus-specific antibody levels and (b) clinical cold symptoms. On the basis of controlled studies, it also appears that psychosocial therapy can contribute to reducing morbidity and even mortality from cancer and cardiovascular disease (Ornish et al., 1990; Spiegel, Bloom, Kraemer, & Gottheil, 1989).

The case study presented in the previous section illustrates one set of promising diagnostic and therapeutic procedures that primary care residents and faculty can be made aware of. Some psychologists or residents may even choose to learn to administer these procedures to so-called difficult patients. These patients often are unwilling to accept psychiatric referral. The quantitative and objective nature of the data collected before, during, and after psychophysiological therapy (as illustrated in the case study) may facilitate the documentation of the empirical efficacy of psychophysiological procedures for HMOs.

Family medicine and psychology should accept responsibility for developing a high technology of behavioral science. This technology can focus on at least the prevention, diagnosis, and therapy of the following: (a) somatization disorders, (b) behaviors lethal to health (e.g., smoking, lack of exercise, and so forth), and (c) the early detection of children and adolescents who are at risk for stress-related disorders such as primary hypertension or irritable bowel syndrome. Psychophysiological procedures like the PSF can be used, for example, to identify adolescents who are at risk for hypertension (Blascovich & Katkin, 1993). At-risk adolescents can be taught psychophysiological skills through self-hypnosis or computer-assisted biofeedback to determine if psychologists can prevent or postpone the development of hypertension, irritable bowel syndrome, or functional chronic headaches. Patients high on hypnotic ability appear to have flexible, holistic, cognitive styles that respond most rapidly to verbal instructional procedures like hypnosis, relaxation instructions, cognitive behavior therapy, and autogenic training (Wickramasekera, 1976, 1988, 1993), whereas those who are low on hypnotic ability appear to have skeptical, analytic, cognitive styles that require objective, quantitative documentation from biofeedback or physiological instruments to amplify their perception of unconscious negative emotions such as anger, depression, or fear (Wickramasekera, 1988, 1991, 1993, 1995). The biofeedback instruments can operate like truth detectors (Green & Green, 1977). It is also likely that some children or adults who have high hypnotic ability (and,
hence, have high sympathetic hypersensitivity) learn to abuse substances (food, drugs, and so forth) to self-soothe this aversive (guilt, hurt, shame) hypersensitivity (Wickramasekera & Atkinson, 1993). Identifying and teaching these people self-soothing psychophysiological skills and other coping skills may reduce the risk of chronic substance abuse. Patients like Susan and some substance abusers tend to be managed ineffectively, expensively, and sometimes iatrogenically, because no effective alternative modes of diagnosis and therapy are available. Standard mental health procedures initially have low credibility or face validity for patients with objective physical symptoms like allergic skin reactions, nausea, vomiting, flatulence, diarrhea, and constipation.

Biofeedback and empirically based hypnosis (Fromm & Nash, 1992; Rhue, Lynn, & Kirsch, 1993) are now recognized as mainstream therapeutic modalities, and their neglect by psychologists within primary care practice is perplexing. Nothing comparable to the strength of commitment given to family therapy in family medicine (Smilkstein, 1994) has evolved with regard to psychophysiological methodologies. A number of reasons can be postulated for this situation. First, there has been a general lack of insight regarding the applicability of these methods to primary care practice. Family physicians and many psychologists are largely unaware of the achievements within the fields of basic and applied psychophysiology. The special section in this issue brings this information together so that it can be shared with psychologists and primary care physicians. Family medicine has been preoccupied with the pursuit of first principles. Questions such as the role of the family in family medicine and the impact of family dysfunction on disease presentation and development have been prioritized. Ironically, the theoretical nature of such concepts and the relatively limited, immediate, practical benefits that result from their application to clinical practice probably explain, at least in part, the low level of enthusiasm for family therapy among many rapid-outcome-oriented family practitioners. The principle espoused by Wickramasekera (1988), “First put out the fire, and then look for the matches,” would make a great deal more sense to busy, result-oriented clinicians. Wickramasekera (1979, 1988, 1995) proposed a risk factor reduction approach to the therapy of somatization disorders in primary care. The potency of many of these risk factors (e.g., life change, support systems, coping skills, and so forth) is already empirically documented by independent investigators. He also demonstrated the empirical basis of HRMTP in a controlled study (Wickramasekera, 1995), and its empirical efficacy in therapy has been shown in several controlled case studies of so-called difficult patients presenting a variety of complex autonomic nervous system symptoms resistant to standard biomedical diagnosis and therapy (Wickramasekera et al., 1976, 1988, 1989, 1993, 1994b; Wickramasekera & Atkinson, 1993). The complexity of the HRMTP and the specialized training and supervision required to measure hypnotic ability with tests like the Stanford Form C or the Harvard test are constraints on the use of the HRMTP. Wickramasekera (1993) proposed that a primitive but reliable measure of hypnotic ability can be secured with the Absorption Scale (Glisky et al., 1991; Tellegen & Atkinson, 1974) in 10 min. Initial testing for risk factors can be limited to only the following predisposers: hypnotic ability, catastrophizing, neuroticism, and the Marlowe Crowne Scale score. In fact, two independent studies done in primary care centers with this abbreviated battery have produced promising results.

The case study described in the previous section was deliberately presented in enough detail to illustrate the complex and technical nature of applied psychophysiology but also to show the promise it holds for illuminating some major issues in psychodynamic theory. Mechanical use of biofeedback instruments, a non-theory-driven or empirical approach to biofeedback research, and an effort to ignore (rather than mobilize in controlled forms) the activity of powerful nonspecified factors (e.g., hypnotic ability, accurate empathy, warmth, and so forth) have obstructed progress in applied psychophysiology. Furthermore, some methodologically sophisticated studies have demonstrated trivial treatment effects, which are unlikely to be reimbursed. Other likely reasons for the previous neglect of psychophysiology in primary care practice may then relate to the clinically and technically naive use of biofeedback and the difficulties associated with reimbursement.

An action plan is currently underway to address this spectrum of issues. On an organizational level, professional collaboration is being encouraged between the representative national societies. Presentations by family physicians were sponsored by the Association for Applied Psychophysiology and Biofeedback at its 1995 annual meeting, and discussions are currently underway for reciprocal appearances to be made by leading clinical psychophysiologists at future meetings of the Society of the Teachers of Family Medicine. It is hoped that interaction between these two professional groups will lead to a coalition that will advocate the preeminence of the biopsychosocial model in primary care practice. Joint scientific symposia and practical clinical demonstrations of psychophysiology can also contribute to bridging the gap between the biopsychosocial model and the biomedical model in primary care.

Summary

Clinical, educational, and research demonstration projects are needed in nonpsychiatric primary care medical settings. Wickramasekera (1995) proposed the establishment of a psychophysiology laboratory to “show mind–body interaction in every family medicine residency in the U.S. by the year 2020” (as cited in McKe, 1995, pp. 15–16). Even an abbreviated form of the HRMTP and the Trojan horse approach to somatization can provide a heuristic and systematic method of diagnosis and intervention with difficult patients. Wickramasekera (1988) proposed that therapy for somatization, at least in primary care medicine, have an action-oriented focus on “putting out the fire before looking for the matches” (p. 148). Creative financing approaches have to be explored to underwrite the start-up costs of such ventures, particularly prior to the time that regular and equitable third party reimbursement can be negotiated. Educational grants and philanthropic gifts from grateful patients can be the source of such funding. At the Eastern Virginia Medical School, a clinical program is currently being developed in association with its family practice center. A variety of other challenges remain. The selection of patients and
the credible independent demonstration of cost-effective clinical outcomes (Amar & Schneider, 1993; Schellenberger et al., 1994) are of paramount concern. The lack of understanding of psychophysiology and the existence of a negative bias against the simplistic, mechanistic practice of biofeedback have to be addressed. This spectrum of educational, clinical, research, and financial challenges await those future clinical psychophysiologists who would like a strong bond with primary care physicians, who may be the gatekeepers of health care in the 21st century.

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