

Complementary and Integrative Medicine in Pain Management

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Editors

 SPRINGER PUBLISHING COMPANY
New York

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Springer Publishing Company, LLC
11 West 42nd Street
New York, NY 10036
www.springerpub.com

Acquisitions Editor: Sheri W. Sussman
Production Editor: Julia Rosen
Cover design: Joanne E. Honigman
Composition: Apex Publishing, LLC

08 09 10 11/ 5 4 3 2 1

Library of Congress Cataloging-in-Publication Data

Complementary and integrative medicine in pain management / Michael I. Weintraub, Ravinder Mamtani, Marc S. Micozzi, editors.

p. ; cm.

Includes bibliographical references and index.

ISBN 978-0-8261-2874-4 (alk. paper)

1. Pain—Alternative treatment. I. Weintraub, Michael I. II. Mamtani, Ravinder. III. Micozzi, Marc S., 1953–

[DNLM: 1. Pain—therapy. 2. Complementary Therapies. WL 704 C7367 2008]

RB127.C643 2008

616'.047—dc22 2007051943

Printed in the United States of America by Book-Mart Press.

Dedicated to Anita, Jeffrey, and Lisa, my central energy source.

—Michael I. Weintraub

To Mother Teresa, with whom I had the distinct pleasure of working in Albania in 1991. From her I learnt the value of focusing on the patient as a whole with the symptoms, rather than on the symptoms alone that the patient has.

To my esteemed colleague and my mentor, late Joseph A. Cimino, MD, who continued to encourage and support me in my endeavors aimed at promoting health, and alleviating human pain and suffering.

To my wife, Jaishree, and my children Raashi and Ronac, who have always believed in my work, and continue to remain a constant source of inspiration in furthering my goals of empowering people with information that would enable them to make informed choices concerning health.

—Ravinder Mamtani, MD

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Editors

Michael I. Weintraub, MD, FACP, FAAN, is a neurologist and pain medicine specialist and a leading proponent of complementary and alternative medicine (CAM). He served as the first Director of American Academy of Neurology Course on Alternative Medicine in 1999 and 2000. He has performed original and pioneering research with laser biostimulation in carpal tunnel syndrome and magnetic biostimulation using both static and time-varying magnetic fields to reduce neuropathic pain in diabetic peripheral neuropathy and carpal tunnel syndrome. He has published over 200 articles in leading peer-reviewed journals, provided chapters for several textbooks, written three books, and edited several books.

He has received many awards including being the recipient in 1991–1992 of American Journal of Pain Management Award for Outstanding Contribution to the Interdisciplinary Pain Management Literature with paper “Litigation-Chronic pain syndrome: a distinct entity. Analysis of 210 cases.” He has been named in “Best Doctors in New York” (*New York Magazine*) 4 years in a row voted by his peers.

Dr. Weintraub attended medical school at State University of New York (SUNY) at Buffalo and completed his neurology training at Yale University School of Medicine. He has held faculty positions at SUNY–Buffalo, Yale, Boston University, Albert Einstein College of Medicine as well as his current faculty appointments as Clinical Professor of Neurology and Medicine at New York Medical College, and also Adjunct Clinical Professor of Neurology at Mt. Sinai School of Medicine.

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Dr. Mamtani earned his medical degree from University of Delhi, India, and received his postgraduate training in United Kingdom and at New York Medical College/Our Lady of Mercy Medical Center. He is a Diplomate of the American Board of Preventive Medicine in the specialties of general preventive medicine and public health, and occupational medicine. Well-known for his evidence-based approach to medicine, he sees patients/persons with an interest in preventive and integrative approaches. His clinical interests include lifestyle medicine, and management of patients with chronic pain, women's health issues, stress-related conditions, cancer, and other chronic health problems.

Marc S. Micozzi, MD, PhD, is a physician–anthropologist who has worked to create science-based tools for the health professions to be better informed and productively participate in the new fields of CAM and integrative medicine. He was the founding editor-in-chief of the first U.S. journal in CAM, *Journal of Complementary and Alternative Medicine: Research on Paradigm, Practice, and Policy* (1994). He organized and edited the first U.S. textbook, *Fundamentals of Complementary & Alternative Medicine* (1996), now entering a fourth edition (2008). He served as series editor for *Medical Guides to Complementary and Alternative Medicine* with 20 titles in print on a broad range of therapies and therapeutic systems within the scope of CAM. In 1999, he edited *Current Complementary Therapies*, focusing on contemporary innovations and controversies, and *Physician's Guide to Complementary and Alternative Medicine*.

He organized and chaired six national continuing education conferences on the theory, science, and practice of CAM during 1991 to 2001, cochaired with former Surgeon General C. Everett Koop and Dr. Dean Ornish. In 2002, he founded the Policy Institute for Integrative Medicine in Washington, DC to educate policy makers, the health professions, and the general public about needs and opportunities for integrative medicine. From 2003 to 2005, he accepted an interim appointment as executive director of the Center for Integrative Medicine at Thomas Jefferson University in Philadelphia. He is presently an adjunct professor at the University of Pennsylvania in Philadelphia, and at Georgetown University School of Medicine in Washington, DC, and teaches at Drexel University in Philadelphia, Johns Hopkins University in Baltimore, University of California at Irvine and at San Diego, and George Washington University in Washington, DC.

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Preface

Complementary and alternative medicine (CAM) approaches are currently riding the crest of public enthusiasm. The medical and scientific community, however, remain relatively skeptical and are basically unfamiliar with the specific applications, background history, and specific clinical studies. The pharmacological approach to treatment of various medical conditions is often limited, associated with side effects and high costs. Thus individuals tend to search for another approach that can relieve their pain and suffering.

Specifically, pain syndromes are multifactorial and the role of the psyche is paramount. The goal of this text is to de-mystify the many types of CAM so that physicians can appreciate a potential role in helping patients in a safe and cost-effective manner. We have asked our many expert contributors to provide evidence-based approaches to specific clinical pain syndromes and conditions and a wide range of related neurological conditions. The book is organized according to therapeutic modalities and is divided into four broad sections. The first section relates to modalities that are considered to operate in the realm of mind-body and bioenergetic mechanisms. The second section discusses manual and hand-mediated modalities. The third section addresses alternative medical therapies from Asian healing traditions. The fourth section focuses on the use of herbal remedies, their essential oils, and homeopathy. We also include innovative therapies from within western biomedicine as well as some general, ethical and medical-legal considerations.

We wish to thank our many contributors who have provided their expertise and experience toward making this a clinically useful textbook.

We also want to thank our publisher, Springer Publishing, for all their support and specifically Sheri Sussman and Alana Stein.

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Introduction

Pain is a commonly reported symptom. Patients with chronic pain and other neurological conditions feel helpless and frustrated. The events and stories surrounding their suffering are innumerable and continue to pose challenges for all those concerned with human welfare and health.

Science and medicine have made remarkable progress in many realms. Mortality rates have declined, and people are living longer. This outcome has resulted in changes in disease patterns and patient priorities. Chronic diseases such as arthritis, musculoskeletal pain, mental health problems and neurological conditions such as Alzheimer's and stroke are becoming more common. Those who suffer continue to live and look for ways and means to alleviate their pain and agony.

The modern medicine of today views the human body as a biomedical machine which can be analyzed, and when needed repaired, altered or modified structurally. Surgery remains an efficacious and effective treatment for many trauma situations. The skill of doctors treating acute emergency illnesses remains high. However, the current, high-technology based health care system is not without its limitations and problems.

While the modern health care system is effective in managing infectious diseases, traumatic injuries, and other acute problems, it is limited in helping those with chronic diseases, the causes of which are related to a number of factors. Modern chronic pain treatments such as surgical interventions and pain medications are inadequate for most and, in many instances, are not safe. Those using pain and other medications remain at risk for developing serious side effects.

Therefore, approaches which encourage patients to participate in programs that integrate conventional and complementary/alternative medicine (CAM) treatments are gaining popularity worldwide. Such approaches are producing positive scientific results, as well as forming the basis of a refreshing and a novel integrative method of treatment and healing.

Evidence from scientific studies is beginning to emerge, documenting both usefulness and limitations/risks associated with various treatments. There is sufficient evidence, for example, to support the use of (a) acupuncture for chronic low back pain and dental pain, (b) hypnosis for pain and anxiety; and (c) mind-body techniques such as meditation, yoga, and biofeedback for chronic pain. Medical doctors who utilize these therapies in their practice report benefits both for their patients and themselves. There are some CAM therapies, however, that have yet to show a benefit or might even present an unjustifiable risk to patients. Examples of those therapies include coffee enemas, Laetrile, ozone therapy, megadoses of vitamins and shark cartilage. Use of these unproven or disproven therapies may also result in loss of valuable time and the opportunity to receive potentially beneficial therapies. This book omits these unproven approaches and focuses on those that have proven benefits.

Fostering and nurturing an evidence-based integrative approach that combines both modern medicine and efficacious CAM will not only promote health but also improve the quality of life for patients with chronic pain and other neurological conditions.

PART I

**Mind-Body and
Bioenergetic
Modalities**

Social and Cultural Perspectives on Complementary/ Alternative Medicine in Pain

Marc S. Micozzi

Pain and headache (head pain) are perhaps the two most common functional disorders of the human condition, experienced by virtually everyone on an acute basis, and by many on a chronic, episodic, or recurring basis. Much of the effort in human healing traditions throughout history has been directed at analgesia—the alleviation of pain—through discovery and development of *materia medica* (opiates, salicylates, etc.), manipulation (e.g., bone setting, chiropractic, traditional osteopathy, physical therapy), manual therapies and massage, yoga, acupuncture, and mind-body approaches, all of which are topics in this book. Energy healing represents a new frontier with ancient roots.

In the history of American medicine, alleviation of pain, together with prevention of death, was one of the two central tenants of rational medicine. Rational medicine in clinical practice was a conscious result of the eighteenth-century Scottish Enlightenment (as manifested by the social philosopher, Adam Smith, in economics, for example). It was brought to the then American Colonies by Drs. Morgan and Hutchinson from the University of Edinburgh to the College of Philadelphia (now the University of Pennsylvania), where they established the first school of medicine in what was to become the United States by charter from Colonial Governor Thomas Penn in 1765. The rest is history.

Today, pain is understood as a dynamic condition, not a static pathologic state or lesion. And while curing or removing a painful lesion may eliminate the pain (with the curious exception of phantom pain such as the phantom limb syndrome of amputees), pain exists in many other contexts where there is no lesion to cure or remove. Therefore, the assessment and management of pain, whether alternative or mainstream, must lie in the interaction between mind and body, healer and patient, patient and therapy.

Pain is a subjective complaint, and therefore its improvement is also subjective, yet associated with very high levels of patient satisfaction. That mind-body approaches are proving so successful in the management of pain is another sign that the Cartesian separation of mind and body has been an artificial accommodation to once-limited philosophical and naturalistic understandings of health and healing. This outdated separation in western biomedicine (which is not a factor in Asian medical traditions, for example), perhaps even influences how we are conditioned to experience and express pain itself. In traditional societies in Africa, and elsewhere, psychic pain is often somatized to a specific area of the body and presents as pain in a particular organ rather than as a general mental state.

If the entire body acts beyond the brain-body barrier as the organ of consciousness through the movements of “molecules of emotion” (as postulated by Candace Pert and others), mind-body distinctions begin to lose their meaning. A “gut feeling” is really being felt in the gut. And some of the diffuse pain associated with chronic fatigue syndrome and fibromyalgia, for example, may ultimately be a conditioned response emanating from elsewhere.

The successful alleviation of pain and treatment of other neurological conditions can no longer be considered alternative vs. mainstream—what works should simply be considered good medicine.

Biofeedback

Angele McGrady

Biofeedback (BF) is a mind-body therapy based on operant learning theory. The fundamental principle of BF is that a patient receives information about a specific physiological parameter and with practice, learns to control that aspect of the physiological responses to stress. BF requires monitoring and displaying accurate and meaningful information from a body site in an easily recognizable form. Correct responses are reinforced by sound or visual feedback, facilitating learning. With the guidance of a mental health provider and assuming regular practice of BF, the person can repeatedly and reliably control one or more physiological responses. For example, muscle tension is measured with surface sensors from the forehead; the output is converted to a visual or auditory signal that is made available to the patient, such as a sound that fluctuates depending on the level of tension. Knowing which muscles are tense or relaxed allows the person to learn to self-regulate the physiological process. Un-desirable internal states are associated with increased levels of sound or light, and reinforcement is provided for desired responses, such as relaxed muscles.¹ There are three broad categories of BF treatment: stress reduction in which lower arousal is reinforced; muscle retraining, in conditions where muscle tone is lower than desired; and brain wave training, for disorders in which EEG patterns are associated with specific problems of attention and concentration.

MODALITIES AND DEVICES

Electromyograph (EMG), thermal, skin conductance, blood pressure (BP), brain wave, and heart rate are the most common types of feedback. The EMG measures levels of skeletal muscle contraction, and the raw signal is converted usually to an auditory signal. For disorders in which excess muscle tension and over-arousal are associated with symptoms and lowered responsiveness is the goal, surface monitoring (SEMG) is most appropriate. However, when the objective is to increase motor unit potentials, needle technique is often used. Thermal biofeedback (TBF) provides information about the temperature of the skin, which is correlated with blood flow in the small arterioles underlying the area where the sensor is placed; the most common placement is on the palmar surface of the index or middle finger of either hand, with occasional placement on the underside of the toes. Skin conductance feedback monitors the activity of the sweat glands directly beneath the sensors. Brain wave (electroencephalogram, or EEG) feedback, also called neurofeedback involves monitoring brain wave activity of certain areas of the brain underlying the electrodes. Heart rate and BP feedback provide information about dysregulation of the cardiovascular system.² A newer form of BF is heart rate variability, which facilitates patient learning to control the oscillation (variability) of heart rate.³ Lower heart rate variability has been linked to medical illness, particularly cardiovascular disease. No matter the specific type of BF, all applications share these factors: an instrument is utilized; the person receives information; correct responses are reinforced; and repetition is necessary for success.

MULTICOMPONENT TREATMENT

BF is often coupled with symptom monitoring, relaxation therapy (RT), patient education, psychotherapy, and medical pharmacotherapy. When the primary objective of treatment is lower arousal, relaxation is an integral part of therapy. Relaxation is of two basic types: active or passive. Active relaxation is defined as producing lower arousal by voluntarily tensing and releasing tension from specific muscle groups and learning to differentiate between tension and relaxation. The goal is to be able to consciously lower tension.⁴ Passive relaxation consists of deep breathing or using words, phrases, or imagery. For example, autogenic relaxation uses specific phrases dealing with sensations of heaviness in the muscles and warmth in the hands.⁵ The key to effective relaxation is repetition of phrases or behavior (such as breathing) on a daily basis until a reliable relaxation response can be produced quickly when needed.⁶ Home practice of relaxation with

or without portable feedback devices is critical to learning and long-term maintenance of newly acquired skills. Generalization of the relaxation response to conditions of daily living allows the patient to use relaxation to counter the effects of stressful situations. The experience of decreasing the severity of a stress response or blocking the response with relaxation rather than relying solely on medication increases patients' confidence in their ability to use the technique.⁷ Because different relaxation techniques have specific effects, the provider guides the patient to learn to differentiate among multiple maladaptive psychophysiological responses and to match each signal to a strategy: breathing, passive or active relaxation, or imagery.⁸

Patients are asked to record symptoms and these data are reviewed with the provider at each session. Reliable symptom monitoring prior to, during, and following treatment is necessary to first establish the baseline, then monitor the progress of treatment, and finally determine outcome. Symptom monitoring informs treatment and serves as a source of reinforcement of progress. A pretreatment baseline can be easily established if the patient tracks frequency, duration and severity of symptoms, and use of medication prior to the initiation of BF. The length of the baseline and post treatment is determined by the frequency of the symptom. In addition, the patient becomes fully engaged in the therapeutic process when the occasion of the symptom and the patient's attempts to manage the symptom are discussed.

Patient education provides easy-to-understand explanations of the rationale for BF based on physiological principles. The use of SEMG feedback for disorders of excess muscle tension and tension-type headaches is logical and quickly grasped; the relationship between a high-pitched or high-frequency sound and high tension is intuitively obvious. Other symptom-feedback pairs are less so, necessitating greater efforts to make the required tasks comprehensible to patients. For example, a patient with migraine who is going to learn to warm her hands with TBF might be told the following: "When you are in a stressful situation, your body gets ready to react. This reaction includes tensing your muscles, increasing your pulse rate, and sending blood to your muscles. Thus blood is diverted away from nonessential tissues, like your digestive system and your hands and feet. When there is less warm blood in your fingers, they get cold. With feedback, you will learn to warm your hands consciously. This is part of learning how to decrease excessive responses to stress, which seem to be related to your headaches." Regarding EEG feedback, the explanation for its effects may be as follows: "Certain brain wave patterns are associated with sleep, others with attention and good concentration, and still others with lack of attention or daydreaming. You will be able to learn to generate brain waves that are associated with good concentration and paying attention, instead of being distracted or unfocused."

Psychotherapy is combined with BF for patients who have comorbid conditions such as mood or anxiety disorders. For example, patients with episodic headache may also have generalized anxiety disorder or adjustment disorder with anxiety. Clinical depression is often prominent in patients with chronic headaches or other pain syndromes. A recent study of prevalence of depression and chronic headache showed that in women, chronic severe headache and disability were associated with depression in women. A neuron-psycho-chemical association that supports both pain and negative emotional states was suggested.⁹ Cognitive-behavioral therapy (CBT) is a type of psychotherapy commonly used in conjunction with BF in anxiety and mood disorders. CBT explores negative and irrational thoughts that are contributing to mood symptoms and teaches the patient to counter these thoughts with more realistic approaches to situations. Therefore, the therapy emphasizes generating more positive thinking patterns and acquiring effective coping skills.^{10,11}

It is best but not always possible for the same practitioner to provide both psychotherapy and BF. When a clinical psychologist, clinical counselor, social worker, or psychiatric nurse is also trained in BF, single sessions can integrate psychotherapy, hypnosis, or imagery with BF. For example, the patient might spend the first 30 minutes of a 50-minute session engaged in psychotherapy, and the last 20 minutes practicing BF. On the other hand, the session might consist of 20 minutes of guided imagery-assisted BF to create an atmosphere of trust between patient and practitioner followed by 30 minutes of psychotherapy. The stages of change model may be useful to assess how willing the person is to change,¹² and an experienced therapist is equipped to manage the lack of motivation evidenced by patients in the precontemplation stage or the uncertainty of the contemplation stage.

TREATMENT PROTOCOLS

The number and structure of sessions should be matched to the patient's condition(s) and the severity of the disorders for which treatment is sought. Three basic formats are used in the lower arousal applications of BF: standard, brief, and psychotherapy based. After the clinical interview, and before beginning any BF treatment, a psychophysiological assessment is carried out. This profile consists of measuring muscle tension, skin temperature, heart rate, heart rate variability, and skin conductance under various conditions. First, the patient is asked to sit quietly with eyes closed and then with eyes open. Then, stressful mental imagery or mental arithmetic is used to determine which physiological system responds most acutely. Finally, the patient is then asked to attempt to relax

in any familiar way. Information collected during the last phase of the assessment suggests the extent of past experience that the patient brings to the therapeutic setting.¹³

The standard format of BF therapy consists of 8 to 12, 50-minute sessions of BF, RT, and stress management-oriented counseling.^{14,15} The limited contact protocol includes 3 to 4 sessions of BF and emphasizes home practice of relaxation. This is appropriate for patients who are highly motivated, can follow directions, and have no more than mild psychopathology.¹⁶ An intensive BF treatment protocol is one in which BF and RT are used as adjuncts to psychotherapy, as is common in treating patients with chronic pain.¹⁷ This format is recommended for patients who have long-standing moderate or severe symptoms, who are poorly motivated, whose lives are focused on pain, or who need in-depth psychotherapy to explore emotional conflicts or interpersonal difficulties. New treatment paradigms continue to emerge. Telemedicine can be considered when the clients are separated from the BF clinic by large distances. In a multi-case report, BF was provided through long distance video conferencing with moderate additional expense but successful pain reduction in migraine.¹⁸ A more intriguing suggestion is that of deCharms et al to provide information from real time functional MRI of the rostral anterior cingulate cortex, the area thought to be involved in pain perception.¹⁹

It is important to note that BF and RT are not contraindicated in patients who are also medically managed by physicians. In fact, if pain or disability is severe, the BF practitioner may request that the patient return to the physician for medication to facilitate the relaxation process. As symptoms improve, the need for some types of medicine, particularly analgesics or antianxiety agents, may decrease. When log sheets indicate steadily decreasing symptoms that required medication, the patient is encouraged to talk to the physician about lessening the dosage of drugs. The joint management of patients by physicians and BF practitioners is more the norm than the exception.

Headache

This section addresses BF treatment of tension-type and migraine headache with briefer discussions of application of BF to posttraumatic headache and medication overuse headache. A typical 8- to 12-session treatment protocol for tension-type headache includes the following: SEMG BF with sensors placed on the forehead or back of the neck, active and then passive RT, home practice of relaxation, daily symptom logging, and psychotherapy or stress management as appropriate. Patients are trained to decrease tension levels and to produce a general relaxation response. Because surface sensors placed on the forehead detect a wide range of

muscular activity, responding to grimacing, frowning, and teeth clenching helps patients to regulate muscle tension and decrease pain.¹⁷ The relaxation process is then generalized to stressful situations where patients feel their muscles tensing or notice the early signs of headache. A typical 8- to 12-session treatment protocol for tension-type headache includes the following: EMG BF with sensors placed on the forehead or back of the neck, active and then passive RT, home practice of relaxation, daily symptom logging, and psychotherapy or stress management as appropriate. Patients are trained to decrease tension levels and to produce a general relaxation response.

The literature on BF in tension type headache supports the effectiveness of EMG BF combined with RT. An excellent review of 30 years of research on behavioral therapy of recurrent headaches summarizes the experimental literature on BF.²⁰ In tension-type headache, EMG BF combined with relaxation was superior to wait list control, relaxation alone, and amitriptyline. Two earlier reviews investigated the efficacy of BF through an extensive literature review and analysis by a panel of experts.^{21,22} In the case of chronic pain, there was strong evidence to support relaxation techniques and hypnosis, and moderately strong evidence for BF and CBT. BF worked best with tension-type headaches.²¹ A meta-analysis of 78 publications that included 2,866 participants found that EMG BF alone or combined with RT was superior to no treatment and to pseudo-placebo therapy in tension-type headache.²²

The most common treatment model for nonpharmacological therapy of migraine headache is TBF accompanied by RT. The treatment regimen used in the author's clinic for patients with migraine consists of four sessions of EMG BF and six to eight sessions of TBF combined with passive relaxation, home practice of relaxation, symptom logging, and stress management or psychotherapy as appropriate.²³ Rigorous evaluation criteria have been used to evaluate controlled studies of psychosocial interventions in migraine. Conclusions were that "thermal biofeedback plus relaxation . . . qualifies as an efficacious treatment for migraine headaches."²⁴ BF has also been compared with medical therapy in migraine.²⁵ Abortive ergotamine tartrate was associated with a 30% decrease in headache index in the first month of treatment and an additional 11% decrease later. TBF resulted in an early reduction of 25% and an additional 26% at post-treatment. Seventy-eight percent of the BF group and 40% of the medication group decreased analgesic use by a minimum of 50%.²⁶ In a meta-analysis involving 2,445 patients with migraine, BF was found to be equivalent to propranolol; both resulted in a 43% improvement in headaches according to patients' diaries. Placebo yielded a 14% improvement, and monitoring alone produced no changes.²⁷ For migraine headache, temperature BG and relaxation was comparable to

propranolol, superior to wait list control or placebo medication and not as effective as flunarizine.²⁰ Vasudeva et al compared the results of BF in migraineurs with and without aura.²⁸ Although MA demonstrated the more typical patterns of cerebral blood flow, both groups responded equally well to improvement not related to presence of aura or to differences in CBF.²³ Long-term maintenance of headache improvement mediated by BF and RT therapy is good if patients are able to generalize the relaxation response to stressful situations and continue to use the adaptive coping techniques learned during therapy.²⁹

Posttraumatic headache and high medication consumption headache are two problems that pose special therapy challenges for practitioners of BF. Forty subjects with posttraumatic head pain were treated with EMG BF, TBF, and RT. Of the subjects, 53% reported at least moderate improvement in the number of headaches, and 80% found that the therapy increased their ability to relax and cope with the pain. In general, chronicity of posttraumatic pain predicts a poorer response for improvement in therapeutic paradigms dominated by BF.³⁰ Another challenging population of headache patients is the group who use high doses of multiple classes of medication. Withdrawal of medication, which can be accomplished, although with difficulty, on an outpatient basis, should precede treatment in this group. In a small study of 10 patients, progressive relaxation and BF were found to be helpful in 6 of the 10 patients who were treated. Pain levels and medication use were reduced. However, the involvement of the therapist who provided the CBT was critically important to success.³¹

Grazzi et al tested the effects of BF in a groups of patients with transformed migraine who overused analgesics.³² The protocol called for inpatient setting with either a complicated pharmacology management program or with the addition of BF with relaxation. The combined group showed fewer headache days and fewer patients relapsed than the group with medicine alone. Although trends were observed earlier, significant group differences were found only at 36 months, which emphasizes the difficulty in obtaining successful outcome in this patient group.

Children and the elderly are also appropriate candidates for BF therapy. Although the widespread belief that children acquire BF skills much faster than adults is not supported by statistical analysis of outcome data, children's success rate are higher than adults, perhaps because most children do not present with the depressive features so common in adults who struggle with daily pain.³³ Younger patients are often intrigued by the BF equipment, are comfortable with video game type technology, and adapt to the treatment setting quite easily. Holyrod and Drew provided a relaxation CD for children with headaches to use at home and obtained a successful outcome.³⁴ Both standard and

minimal contact models of treatment have been tested and found to be effective in childhood migraine and tension headache.³⁵⁻³⁸ Trautman et al conducted a meta-analysis of 23 studies comprising 935 children and adolescents with recurrent headache in which relaxation, biofeedback, CBT, or combined treatments were tested.³⁹ The success rate of 70% in the treated subjects was significantly better than the 30% of controls who were successful. Elderly persons often require additional sessions and learning may be somewhat slower. Nonetheless, EMG BF has been found to help decrease total headache activity and increase headache-free days in elderly persons.⁴⁰

Musculoskeletal Pain

Patients with chronic pain often report a myriad of psychological and physical symptoms. In addition to pain, patients suffer from sleep disturbance, vague sensations of discomfort, anxiety, and depression. Therefore, successful treatment must comprise interventions for each dysfunction of mind and body. For example, treating patients with chronic low back pain requires a multimodal approach that combines BF with other modalities such as physical therapy, exercise, correction of gait and posture, and CBT.

Although BF will not be the sole therapy, BF is useful in training general relaxation and in correcting specific muscle tension problems. Fifty-seven patients with chronic back pain were provided with EMG BF from the site of the pain and were taught tension-reduction exercises. The EMG BF group did better than either the CBT group or the patients who continued medical treatment alone. At 6- and 24-month follow-up in the BF group, there were significant reductions in pain severity and fewer visits to the health care system.¹⁷ It is important to monitor tension when the patient is in postures other than reclining in a chair because muscles automatically relax if the head is supported by a head rest. Poor posture, bracing, insomnia, and depression are often contributory or perpetuating factors in the long-term pain patient. So EMG BF is provided to the patient while he or she is in the sitting and standing positions. In addition, CBT may be necessary to modify maladaptive thoughts and behaviors as with other chronic pain conditions.⁴¹ In this population, follow-up sessions are strongly recommended because continued relaxation practice is a key component in maintaining improvement. Relapse can occur after patients have learned the basic skills, particularly if lifestyle and posture have not changed.⁴²

Similarly to the findings in the headache literature, age past 60 years does not contraindicate BF treatment of patients with chronic pain.⁴³ Review of mind-body therapies for older adults with pain from

osteoarthritis showed that older and younger adults did equally well on achieving the criterion of 50% reduction in symptoms after BF; there was moderate evidence to support progressive muscle relaxation and guided imagery.⁴⁴ A 12- to 16-session EMG BF and RT protocol integrated within a multidisciplinary pain program was used to treat an elderly group of patients with cervical pain. The older adults did as well as the younger adults in acquiring self-regulation skills and achieving reduction of pain.⁴⁵ A Cochrane review summarized the effectiveness of behavioral therapies in chronic back pain and concluded that mind-body therapies have a moderate positive effect on pain compared with usual medical care or controls (effect size .62).⁴⁶

Fibromyalgia is a complex psychophysiological disorder that is manifested by muscle pain, tender points, and sleep disturbance; many sufferers also report headache, fatigue, memory problems, anxiety, and depression. Environmental conditions such as changes in weather and noise level that interrupts sleep are often reported to exacerbate the pain and discomfort. This chronic illness is severely distressing; and physical symptoms are intensified by chronic stress. The person who is already anxious is more aware of body pain and then becomes more anxious when feeling pain.⁴⁷

Management of fibromyalgia syndrome is guided by an evidenced based step wise treatment plan.⁴⁸ Mention that chronic pain changes the brain action potential summation of pain stimuli. CBT decrease severity and improve function. Step 1 is diagnosis, then beginning low dose tricyclic antidepressant and CBT. The cognitive component is of major importance, since more intense pain due to mood state may be misinterpreted as worsening of the syndrome. There is strong evidence for efficacy of CBT and moderately strong evidence for the efficacy of BF in fibromyalgia. According to Astin, mind-body therapy in fibromyalgia was effective in increasing self efficacy but not specifically pain.⁴⁹ A program of 6 weeks of symptom monitoring followed by 12 sessions of EMG BF was associated with a reduction in pain intensity. The number of doctor and hospital visits was another factor contributing to the reduction of pain.⁵⁰ Change in perception of pain from an experimental thermal pain stimulus was reported in normal subjects and in eight pain patients after training with feedback from the rostral anterior cingulate cortex. A protocol of 3 training days, 1–5 runs of 13 minutes each was associated with decreases in the intensity of pain in the patients.¹⁹

In therapy of temporomandibular disorders, Sherman and Turk recommend that the psychological-behavioral approaches be used with the medical-dental treatments at the time of the initiation of care and not as a last resort.⁵¹ Supporting this contention is the observation that tension levels may not be significantly higher in patients compared to

nonpain controls, so factors besides actual muscle tension must be considered in treatment.⁵² Positive outcomes in pain reduction were found in almost twice the number of patients treated with SEMG BF compared to no treatment.⁵³ The incorporation of four sessions of CBT (including progressive relaxation, diaphragmatic breathing, and home practice) into usual care improves pain and decreases the extent of interference with normal activity. The review by Crider et al concludes that surface EMG with adjunctive CBT is efficacious in temporomandibular disorders.⁵⁴

Once again, therapy of chronic neck pain must comprise patient education, relaxation, BF, and CBT. Patients receive explanations of the transmission of the pain signal, increase awareness of and reduce the bracing response, and learn the muscular relaxation response. CBT is used to decrease the habitual negative cognitions that impact the pain experience, including the concept of maladaptive muscle contractions.⁵⁵ In a 3-year follow-up of workers with neck or back pain who were on sick leave, the workers who were treated with CBT including relaxation and imagery demonstrated increased scores on the SF-36 (a quality of life inventory that assesses the interference of physical and emotional symptoms on function); more employees returned to work in comparison to the usual care group.⁵⁶ The cost effectiveness parameter was significant only for the women in the study. Although not specifically BF because a monitoring instrument was not used, a unique educational feedback intervention was tested in 126 patients with uncomplicated cervical strain who presented to their local emergency room. The experimental group watched a 12-minute video that consisted of education about muscle strain, psychological factors that may affect pain perception and demonstration of deep breathing. All variables assessed (verbal pain rating, ER visits, taking narcotics, and number of urgent care visits) were significantly lower than patients receiving usual care.⁵⁷

Osteoarthritis (OA) and rheumatoid arthritis (RA) are two disorders that differ biologically but share the pain disability associated with pain and emotional distress. Dixon et al grouped data from patients with either OA or RA in a meta-analysis to investigate the effects of psychosocial interventions.⁵⁸ A compilation of 23 CBT studies and 5 stress management studies resulted in significantly lower pain post treatment and improved coping compared to control conditions in both RA and OA. Grouping data from patients with both forms of arthritis makes more sense if the primary outcome variables are nonbiological but rather reported pain and psychosocial factors that affect pain. Similarly to other pain conditions, older adults with arthritis pain do as well as younger adults; a review of mind-body therapies for older adults supported the application of BF, guided imagery, and progressive relaxation.⁴⁴

ANXIETY AND MOOD DISORDERS

Anxiety and mood disorders are common psychiatric conditions as well as frequent companions to medical complaints, such as chronic pain. Anxiety disorder may present as cognitive symptoms such as fear of losing control, dying, or going crazy, or as somatic symptoms such as racing heart, sweating, or shortness of breath. Sub-clinical anxiety syndromes often cause sufficient distress and functional impairment to merit therapy.¹¹ Appropriate candidates for BF include patients with psychiatric illnesses who can learn to modify specific physiological or psychological responses associated with their disorder.⁵⁹ In one study of school-age children, teachers identified 150 students as “anxious,” although the children were not diagnosed with a specific disorder by a mental health provider. Twelve sessions (six SEMG and six TBF) were provided during a 6-week period. Significant reductions in situational and trait anxiety were reported.⁶⁰

Learning facial relaxation with BF promotes lower central and autonomic nervous system activity and can be effective in managing both the somatic and cognitive components of anxiety.⁶¹ Generalized anxiety disorder was treated in 38 diagnosed adults and in an additional 7 subjects with sub-clinical symptoms. Fifteen sessions of EEG feedback resulted in decreased self-reported and observer-rated anxiety and in improved quality of life.⁶² The effects of eight sessions of frontal EMG BF or EEG feedback to increase or to decrease alpha wave activity, or pseudo-meditation control, were compared using a standardized self report inventory. All treated subjects reported significantly decreased anxiety symptoms, which were maintained at 6-weeks follow-up. The authors suggest that in anxiety, the effects of BF may be nonspecific.⁶³

With phobic patients, RT is integral to systematic desensitization therapy; gradual exposure to the phobic stimulus is combined with guided relaxation. Psychophysiological approaches including BF and RT are suggested as a first step in management, to be followed by medication if necessary. BF can shorten the time required to learn relaxation under conditions of exposure to the phobic stimulus.⁶⁴ Syncope (discussed in more depth in the subsequent section) can also be symptomatic of simple phobia. For example, the sight of blood or injury can result in loss of consciousness in susceptible individuals. In a single case study, EMG and TBF were combined with systematic desensitization to treat an individual with long-standing blood injury phobia. With therapy, the individual learned to identify presyncopal cues and used BF and RT to block syncope when confronted with the phobic stimulus.⁶⁵ Neurofeedback has also been used to treat anxiety disorders, particularly generalized anxiety and phobias.⁶⁶ Combined with EMG feedback, alpha enhancement training

produced a decrease in anxiety scores beyond the placebo effects. According to APA criteria, neurofeedback is categorized as probably efficacious for anxiety.⁶⁶ It should be mentioned that working with patients with PTSD, another of the anxiety disorders will always require therapy beyond BF and relaxation. Because some of the causes of chronic pain are events, like motor vehicle accidents or serious work injury, patients should be evaluated for the presence of posttraumatic stress disorder before BF is initiated.⁶⁷

BF has not traditionally been recommended for patients with major depressive disorder or dysthymia. Although there are no contraindications or reports of worsening of depression after BF, the stress management applications presuppose a higher level of sympathetic autonomic arousal, which has not been a characteristic of depression. However, depressed chronic pain patients' sense of helplessness regarding their pain and the limitations induced by pain is a common observation. Because BF is based on the principle of patients' gaining a sense of control over their maladaptive physiology, the experience of success can be translated into a sense of self efficacy. During the course of therapy, the major nonspecific effect of BF, that is, developing the sense of control over physiological responses to stress can facilitate learning of pain control.⁶⁸ In summary, assessment of mood is recommended as part of the evaluation for BF for any chronic pain condition; if found, even in sub-clinical severity the nonspecific effects of BF may be mobilized and directed towards improvement in pain and mood while psychotherapy remains the cornerstone of therapy.

AUTONOMIC NERVOUS SYSTEM DISORDERS

Syncope, near syncope, and dizziness are symptomatic of many primary and secondary autonomic disorders. Neurocardiogenic syncope is associated with hypotension and bradycardia; dysautonomia is characterized by progressive and gradual loss of consciousness, which commonly occurs during walking or standing. The rate and magnitude of fall in BP varies among autonomic disorders, but the disorders share the common feature of postural hypotension. Diagnosis is made by tilt table testing, and treatment usually combines pharmacotherapy and behavioral therapy.^{69,70} Psychiatric disorders are common in patients with autonomic disorders. Anxiety, mood, substance abuse, and somatoform disorders are common, and evidence supports a common pathway mediated by serotonin. In the case of depression, a relationship between lower BP and depressive symptoms has been proposed.⁷¹

A case series of 10 patients who were tilt positive and diagnosed with one of the autonomic disorders used BF as part of overall management.

Patients had headache, lightheadedness, dizziness, near syncope, or true syncope. Therapy consisted of 10 to 12 sessions of EMG, TBF, and RT. Active relaxation and EMG BF were introduced initially, followed by TBF and passive relaxation. Five of the 10 patients obtained clinically significant improvement in each of their symptoms. Six of the seven with syncope had none at post-treatment.⁷² Modifications to the standard BF protocol are necessary to address the multiple responses that comprise presyncope and syncope. In the initial stage, presyncope, when heart rate and BP are elevated, passive relaxation and hand warming are recommended. Then muscle tensing is used to counter the lightheadedness that is associated with the beginning of the syncopal episode. Patients also apply either progressive or autogenic relaxation to tension-type and migraine headache respectively.⁷³

Similar behavioral techniques have been applied to individuals who demonstrate orthostatic intolerance after exposure to microgravity in space. Pilots were trained with BP BF to increase BP under supine and head-up tilt conditions.⁷⁴ Autogenic therapy and BF were applied to control motion sickness in otherwise healthy and well-conditioned astronauts. The protocol comprised training multiple physiological responses simultaneously for a total of 6 hours. Transfer of the responses learned in the laboratory to a variety of stimulus conditions, such as rotary chair, flight, and shuttle missions, was accomplished.⁷⁵

SLEEP DISORDERS

Categories of disturbed sleep relevant to this chapter include primary insomnia (one of the dysomnias) and insomnia related to chronic pain. Patients with recurrent pain report difficulties in initiating and maintaining sleep, and the results of a poor night's sleep are daytime fatigue and problems functioning. Besides disordered sleep as a consequence of pain and psych disorders, sleep deprivation, particularly resulting from continuity problems (not simply fewer total hours), increases awareness of pain and may disrupt endogenous pain inhibitory mechanisms in the brain.⁷⁶

Sleep hygiene is always important and should be tried first. Not only are the recommendations relatively simple, but the physician encourages the patient to begin taking responsibility for healthful sleep instead of relying on prescribed medication. Review of the literature on mind-body therapies for sleep disorders supports progressive relaxation, CBT, and stimulus control but does not favor BF alone as treatment of sleep disorders in either primary insomnia or sleep disturbance in chronic pain patients. Progressive relaxation facilitated improvements in decreasing sleep onset time.⁷⁷ In contrast, the best evidence to date does not favor

BF alone for treatment of sleep disorders in either primary insomnia or poor sleep in chronic pain patients. Stimulus control therapy is based on the premise that patients have learned to associate the bed with anxiety or stress instead of with relaxation and drowsiness. Patients are encouraged to remove any stressful stimuli from the bedroom and recondition bedtime as a time for relaxation and mental quietness.⁷⁸ Morin et al concluded from a review of two meta-analyses that progressive relaxation and stimulus control were well validated and efficacious interventions. CBT was incorporated into a multifaceted program for insomnia.⁷⁹ Fifty-eight percent were at least somewhat improved and 91% reduced medication; most encouraging was the finding that improvements were stable.⁸⁰

EPILEPSY

Since the first case study was published in the early seventies, EEG BF has been studied as an adjunct or alternative to anticonvulsant medication. EEG BF has helped individuals with epilepsy to decrease the frequency of seizures and improve performance on neuropsychological testing, as reviewed below. Currently, there are two BF paradigms that are used to provide training in epilepsy. One is based on using the slow cortical potential shifts (SCP) and the other is configured to train with sensorimotor rhythm (SMR). Positive SCPs are associated with cortical inhibition and reduction in seizure frequency, while negativity may reflect cortical hyperexcitability.⁸¹ Twenty-five patients with focal seizures and intractable epilepsy were offered 35 sessions of SCP BF and 20 sessions of behavioral self-control training. The patients, who evidenced fewer seizures at 1-year posttreatment compared with the 3-month baseline, evidenced less negative SCPs.⁸² The use of SMR as the training module in patients with epilepsy (mostly patients that had already failed anticonvulsants) was reviewed by Serman.⁸³ Eighty-two percent of 174 total patients in multiple studies achieved reduction in seizure frequency and 5% remained seizure free at 1 year. Although seizure control can be enhanced with BF, patients need to be able to transfer or generalize the training in order to use the technique outside of the clinic in order to obtain a long-term benefit. Kotchoubey et al found that successful patients were younger than age 35, were motivated, had sufficient hours of training, and were not on large doses of anticonvulsant medications.⁸⁴ Eighteen of 25 patients learned to control their SCPs with 29 one-hour sessions and obtained improvement in seizure frequency. At 1 year, 6 were free of seizures.⁸⁵ The American Academy of Child and Adolescent Psychiatry states that neurofeedback for seizure disorders meets criteria for clinical guidelines, that is, practitioners should always consider feedback as a treatment

option.⁸³ In summary, there is supporting evidence for BF in epilepsy; however, practitioners of general BF will require an understanding of neurophysiology and the neurology of epilepsy and specialized training in neurofeedback to expand their practice into this complex area.

REHABILITATION

Based on the impact of psychological factors in patients undergoing rehabilitation, the clinician should enhance patients' motivation, reinforce positive psychological and physical change, and foster adaptation to lingering disability. BF provided to patients undergoing rehabilitation emphasizes motor learning which depends on practice and feedback (information). Using an operant conditioning paradigm, patients learn to discriminate between different levels of muscle tension. With accurate and rapid information from the BF device, higher levels of activity in specific muscles can be reinforced, while relaxation of other muscles is promoted.⁸⁶ In the rehabilitation hospital, BF equipment can be transported to the patient's bedside to avoid the counterproductive effects of transporting patients to the physical therapy clinic. Several examples of the use of BF in rehabilitation are discussed here; more extensive coverage of this topic may be found elsewhere.⁸⁷⁻⁸⁹ One-hundred patients with spinal cord injury at C 6 or higher for longer than 1 year were offered EMG BF. The goal was to increase voluntary responses from the triceps muscles. After one to four BF sessions, a significant increase in EMG activity from the triceps muscle was observed.⁹⁰

Patients with paretic muscles can be trained to recruit motor units and to produce a stronger voluntary contraction. In this context, BF protocols are designed to complement and build on naturally occurring sensory feedback. A three-stage process of neuromuscular reeducation is suggested. In stage one, the patient learns to contract and relax muscles voluntarily. Stage two comprises joint movement and posture. The third stage focuses on generalization of learning to the complex functions which are necessary for daily living. Improvements in stage-three skills do not occur after training directed only to stage one.⁴¹ A group of 10 patients with hand dystonia were provided with EMG BF emanating from the proximal large limb muscles that manifested maximum tension and overactivity during writing. After a minimum of four sessions, 9 of the 10 patients reported improvement in handwriting and lessening of pain.⁹¹

For stroke patients in the rehabilitation setting, BF can be used to enhance the effects of exercise, to strengthen weakened muscles, and to return to more normal posture and gait. A meta-analysis was performed on data from eight studies in which EMG BF was compared to physiotherapy

to improve lower extremity function in post-stroke patients. The findings pointed to EMG BF as more effective than conventional physiotherapy alone for improving ankle dorsiflexion muscle strength.⁹² Phantom limb pain was treated with BF 90 minutes daily for 10 days and found to reduce pain and change the cortical reorganization that had occurred as a result of the pain.⁹³

In the rehabilitation setting as well as in the BF clinic, acute pain is appropriately treated with pharmacotherapy whereas chronic pain requires a combined medical, behavioral, and psychological approach. Chronic pain is partially a learned behavior; repeated episodes of pain change the neuronal arrangement in the somatosensory cortex areas and the memory areas.⁹³ New applications of operant conditioning and BF may be addressed to the extinction of pain memories.⁹⁴

ATTENTION DEFICIT/HYPERACTIVITY DISORDER

Treatment of children, adolescents, and adults with attention deficit/hyperactivity disorder (ADHD) is not founded on the lower arousal principle of BF. Rather, treatment is based on individuals learning to regulate brain wave activity in a manner similar to EEG training in epilepsy. If ADHD and ADD are associated with neurologic dysfunction in cortical and prefrontal lobe areas as summarized by Monastra and colleagues then learned control of brain wave activity can translate into improved attention, better task completion, reduced impulsiveness, and less hyperactivity.⁹⁵ Amelioration of symptoms is proposed to occur after multi-session (30–40 sessions for the inattentive type and more if hyperactivity is present) BF therapy to increase beta activity (14 hertz) and to inhibit theta (4–8 hertz).^{96–98} The proximate goal of therapy is to train the patient to recognize abnormal EEG frequencies and to produce less slow wave activity.⁹⁹ For example, the beta/theta ratio was used as feedback in a 6-month training paradigm; compared with controls, the experimental group reduced inattentive behaviors and improved composite IQ scores. Therapists always remained in the room with the patients, providing additional encouragement and helping the children stay on task.¹⁰⁰

EEG BF training has traditionally been used in therapists' offices and clinics. However, the large number of sessions required to learn the skill suggests that the school setting might be a practical alternative. Small numbers of students could be provided with daily EEG training sessions as part of the school day.¹⁰¹ Monastra and colleagues offered 100 children between 6 and 19 years old standard treatment with medication, parent counseling and school consultation or the same plus neuro-feedback.⁹⁵ One-year post training, behavior scores and TOVA (test of

variable attention) remained in the normal range for the BF kids when they discontinued medication but not the non BF group. Four sessions of heart rate variability feedback were offered to children with ADHD. A significant correlation was found between heart rate variability and symptoms of ADHD, suggesting that this may be another viable feedback modality that can be effective with fewer sessions than neurofeedback. Scores on the Connors Inventory decreased after training.¹⁰² A preliminary pilot study of 30 sessions of EEG feedback in children in a partial hospitalization program, also used the Teachers Connors Inventory as an indicator of improvement. Although scores on the hyperactivity and ADHD subscales improved after training in comparison to the control group, no significant correlations between measured brain waves and improvements were found.¹⁰³

Home EEG equipment may be available in the future, so the required daily training sessions can be provided at home under the guidance of motivated, trained parents. Much like the limited therapist protocols for the lower arousal applications of BF, motivation and the ability to understand and follow instructions become critical factors influencing success.¹⁰⁴ The use of BF in ADHD remains controversial; stimulant medication is the gold standard and studies, though numerous and positive are often flawed.¹⁰⁵ Therefore, the consideration of BF for children and adolescents with symptoms of attention deficit with or without hyperactivity should include an accurate diagnosis, standard assessment tools such as the Connors Inventory and a well-constructed treatment plan matched to each person's ability and disability. The general BF provider will need training in the specialized equipment necessary to monitor and display the brain wave signal and a solid understanding of the characteristics of the disorder and an aptitude and desire to work with young children and adolescents.

CONCLUSION

There is strong scientific evidence for the efficacy of BF as treatment for several neurologic disorders, particularly tension-type and migraine headache. The effects of BF may be specific, nonspecific, or both. Nonspecific positive effects are mediated by gaining confidence, improving concentration, and developing more effective coping strategies. The primary effects of BF, in which control of individual physiological processes such as brain waves or muscle tension is learned, may also be specific. BF actively involves the patient in the therapeutic process; therapy is a partnership between provider and patient. Immediacy and accuracy of the BF information are critical, but the relationship between the practitioner

and the patient remains important in all but a few of the treatment protocols. Patients with stress-related disorders have acquired maladaptive response patterns that have led to dysfunctional coping and oversensitivity to stress. Even neutral stimuli are perceived as threats so that, over time, risk for somatic manifestations of psychological conflict increases dramatically. Patients who react maladaptively clearly need new skills, but skills may not be enough. The assessment of a chronic pain patient must comprise psychological and emotional aspects in addition to physical aspects. The ability to self-regulate entails more than simply learning a technique. Self-regulation requires a conceptual shift towards the realization that control of physiological and psychological responses is possible. As the patient learns to self-regulate, sensory information is processed differently. For example, pain is interpreted as a message from the body, not as an inevitable prelude to an incapacitating migraine. The reply to the message involves skills only in part, but cognitive adjustments and positive psychological responses are also necessary. Although the practitioner begins with a framework and a standard treatment package in mind, the therapy should be flexible enough to be modified for individual patients. The challenges of future research are to expand the applications of BF, to develop an understanding of mechanisms, and to differentiate the subtypes of patients and disorders that are most appropriate for BF therapy.

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