

Behavioral Approaches to the Treatment of Migraine

Kenneth A. Holroyd, Ph.D.,¹ and Jana B. Drew, Ph.D.¹

ABSTRACT

Behavioral interventions such as biofeedback training, relaxation training, and cognitive-behavior stress management therapy have been identified as efficacious treatments for migraine headache. These treatments, and the formats (clinic-based, limited-contact, and home-based) in which they are taught, are described in this article. Information about public health interventions (school, work, Internet, and mass media) is also briefly addressed. Results of studies examining the efficacy of behavioral treatments, how behavioral treatments compare in effectiveness, and how they can be integrated with pharmacotherapy are reviewed for both adult and pediatric populations. Finally, the role of behavioral treatments in migraine treatment guidelines is discussed, and factors that are associated with response to behavioral treatments are reviewed.

KEYWORDS: Migraine, behavior, biofeedback, cognitive, efficacy, guidelines

Behavioral interventions provide a treatment option that can enhance or, if necessary, replace pharmacotherapy. The goals of behavioral treatment are to increase the patient's control of their headaches, reduce the frequency and severity of headaches, reduce related disability and affective distress, and limit reliance on poorly tolerated or unwanted medications. Behavioral interventions generally emphasize prevention of headaches, although behavioral headache management skills can also be used to influence the severity of headaches once they've begun. This article will review the most commonly used behavioral interventions, the efficacy of these treatments, their use with medication, and the incorporation of behavioral interventions into treatment guidelines.

BEHAVIORAL INTERVENTIONS

Relaxation Training

Relaxation skills increase control over headache-related physiological responses and, more generally, lower sym-

pathetic arousal. Patients practice a graduated series of relaxation techniques (e.g., diaphragmatic breathing, progressive muscle relaxation, relaxation imagery) for 20 to 30 minutes per day. As they learn the difference between the tense and relaxed state, briefer relaxation techniques are introduced and they are encouraged to relax throughout the day as preventive therapy and, at headache onset, as an abortive measure.

Biofeedback Training

Thermal, or hand-warming, feedback (feedback of skin temperature from a finger) and electromyographic (EMG) feedback (feedback of electrical activity from muscles of the scalp, neck, and sometimes the upper body) are the commonly used biofeedback modalities, although electroencephalographic biofeedback ("neurofeedback"), with the goal of teaching self-regulation of cortical excitability, has received recent attention.¹ Patients, whether using self-regulation skills or a home biofeedback training device, practice this skill for ~20 to

¹Department of Psychology, Ohio University, Athens, Ohio.

Address for correspondence and reprint requests: Kenneth A. Holroyd, Ph.D., Edwin and Ruth Kennedy Distinguished Professor, Department of Psychology, Ohio University, 225 Porter Hall, Athens, OH 45701-2979.

Headache; Guest Editor, Jerry W. Swanson, M.D.

Semin Neurol 2006;26:199-207. Copyright © 2006 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1(212) 584-4662.
DOI 10.1055/s-2006-939920. ISSN 0271-8235.

30 minutes per day and are encouraged to integrate this technique into their daily routine in the same manner as described above for relaxation skills.

Cognitive-Behavior Stress Management Therapy

Cognitive-behavior therapy addresses the cognitive and affective precipitants and components of headache and directs the patient's attention to how thoughts and behavior can generate stress and stress-related headaches.²⁻⁴ Patients monitor the circumstances in which their headaches occur, including their thoughts and feelings prior to headache onset. Once headache-related stressful situations are identified, dysfunctional cognitions are identified and challenged. Cognitive targets may be stress-generating thoughts (e.g., "My presentation for work has to be perfect") or an underlying belief that produces stress-generating thoughts (e.g., "I have to be perfect"). The goal is to teach patients to "catch" and challenge these thoughts, thus controlling stress and other negative affects, and render the patient less vulnerable to stress-related headache.

Integration of Treatment Techniques

Typically, these treatments are used in the context of self-management training that teaches multiple skills, tailoring them to the clinical characteristics of the client's headaches and life situation. Treatment elements include: (1) information about headaches and the principles of behavioral headache management; (2) identification of headache triggers and early warning signs; (3) evaluation of and effective use of headache medications; (4) pain coping strategies for living with headaches that occur despite self-management efforts; and (5) development of a headache management plan that includes coping with headaches following treatment. See Lipchik and colleagues³ for a more detailed treatment description.

TREATMENT FORMATS

Treatment can be administered individually or in a group and in clinic-based, limited-contact, and home-based treatment formats. Additionally, there is growing interest in public health applications of behavioral approaches to migraine treatment, as reviewed below.

Clinic-Based

Clinic-based treatment typically involves 6 to 12 weekly sessions, 45 to 60 minutes long for individual treatment and 60 to 120 minutes for a group. This format provides more health care provider time and attention and allows the provider greater observation of the patient than does a home-based format. However, in regard to clinician

time and patient travel to the clinic, it is more costly. Descriptions of clinic-based treatments are available in Blanchard and Andrasik⁴ for individual treatment and Scharff and Marcus⁵ for group treatment.

Limited Contact

Limited-contact treatment involves three to four monthly treatment sessions, 45 to 60 minutes long for individuals or 60 to 120 minutes for groups. Clinic visits introduce headache management skills and address problems encountered in acquiring or using these skills. Patient manuals and audiotapes typically guide the learning and refinement of skills that are practiced at home, with clinician assistance via telephone calls. Limited-contact and clinic-based treatment formats have yielded similar outcomes when compared directly⁶⁻⁸ or compared via meta-analysis (13 studies).⁹ Lipchik, Holroyd and Nash,³ and Blanchard and Andrasik⁴ provide detailed descriptions of limited-contact treatment.

Home-Based

Three small randomized trials with children or adolescents have reported positive results with behavioral programs in which home learning is supervised by telephone.¹⁰⁻¹² Such programs have the potential to make behavioral treatment widely available as they require neither clinic visits nor the local availability of a behaviorally trained clinician. In the best controlled of these studies ($n = 87$; ages 11 to 18 years), McGrath and colleagues¹⁰ compared multicomponent behavioral programs for migraine (education, relaxation training, stress management, pain coping strategies, assertiveness, problem solving) provided in either an 8-week therapist-administered format or an 8-week home-study format. The home study program included a workbook and audiotapes, with supervision provided via weekly telephone calls. Home study proved as effective as therapist-administered treatment (66% versus 44% of adolescents showing significant migraine reductions, respectively), and both programs were more effective than a one-session control condition that included weekly phone calls.

Cottrell and colleagues¹³ randomized adolescents ($n = 30$; mean age = 14 years) to either an 8-week telephone-supervised home-study program similar to that of McGrath and colleagues, but more tailored for migraine (e.g., biofeedback was added), or to "triptan" therapy. Adolescents' ability to perform four observable migraine management skills was assessed in a clinic visit 1 month after treatment. All adolescents successfully performed at least one skill, and 66% performed at least two skills, suggesting telephone-supervised home study can be reasonably effective in teaching migraine management skills.

A recent study¹² used an interactive computer-administered home-study program that included

education, relaxation training, challenging stressful thoughts, problem solving, and pain coping strategies. The program was contained on a CD rather than the traditional workbooks and audiotapes used in the two previous studies. Children with migraine ($n=37$, ages 7 to 12 years) were randomized to receive the CD plus drug therapy (preventive and abortive medications) or drug therapy alone. Both groups received weekly phone contacts. Children receiving the computer-administered program were more likely to show clinically significant ($\geq 50\%$) reductions in migraine than children who received drug therapy alone.

Telephone-supervised home-study programs appear to be cost-effective ways for some individuals to learn migraine management skills. However, this format is likely to require a motivated patient and, for children and adolescents, a supportive home environment. Additional information is needed about who will benefit from telephone-supervised treatment, the best design of home-study materials for different populations, and optimal methods of supervising home-study.

Public Health Applications

Early behavioral management of relatively "mild" headache problems may prevent the development of more disabling and chronic headaches. However, these individuals often do not seek conventional medical treatment and, thus, may be best accessed through community-level interventions. We refer to such interventions as "public health applications" and review them below.

SCHOOL

In Sweden, Bo Larsson and colleagues have pioneered the teaching of relaxation for headache management in secondary schools. A recent summary of seven relaxation training trials ($n=228$; ages 10 to 18 years)¹⁴ revealed that although students primarily reported tension-type headaches, about a third experienced migraines. Significant improvements were observed in about half the students with migraine who participated in a therapist-administered group relaxation training program. In contrast, results obtained by students who received relaxation training from a school nurse, or who used a self-help relaxation program, did not differ from those in placebo conditions.

WORKSITE

Headaches often impact work performance with costs for U.S. employers estimated at \$20 billion for headache,¹⁵ yet relatively little has been reported on worksite interventions. An exception is a study¹⁶ in which touch screen computer kiosks provided individualized summaries of headache information (e.g., likely triggers, aggravating factors, modified diagnosis based on a computer algorithm) at worksites. Data at a 3-month

follow-up indicated small but significant reductions in headache days but more impressive reductions in urgent care/emergency department visits for headache (1.74 to 0.42 visits in 6 months). High attrition between baseline and follow-up compromised this evaluation, but this pilot study suggests such a program could benefit both patient and employer.

INTERNET

Efforts to teach headache management skills via the Internet have been only modestly effective and have been plagued by high dropout rates.¹⁷⁻²⁰ In the best designed study to date, Devineni and Blanchard¹⁹ enrolled 156 participants from around the world who reported a medical diagnosis of either migraine or tension-type headache in a 4-week online program that included behavioral treatment. Almost 40% of treatment completers recorded significant reductions in headache activity, but over 40% of participants dropped out. Dropouts reported less severe headaches, less improvement, and fewer years of computer experience.

MASS MEDIA

A novel public health intervention in the Netherlands used mass media to teach behavioral skills.²¹ Approximately 15,000 participants purchased home-study materials that presented relaxation and cognitive behavioral skills for managing headaches. Each skill was demonstrated in 1 of 10 TV programs; 10 radio programs presented solutions to problems encountered by participants. Outcome was assessed in only a small subsample ($n=271$), but the 164 participants who completed the program evaluation recorded, on average, a 50% reduction in headache frequency and a reduction of ~ 4.5 days of lost work over 4 months. The strong public interest in this program and preliminary positive outcome data raise the possibility that these skills can be effectively taught via mass media.

Hopefully, the above results will encourage continuing innovation in public health applications of behavior therapy. Data on long-term outcomes including negative "side effects" of public health interventions are needed. For example, it is important that failure with public health interventions does not discourage participants from seeking conventional medical or psychological treatment.

EFFICACY OF CLINIC AND LIMITED-CONTACT BEHAVIORAL TREATMENTS

Adults

The efficacy of behavioral interventions has been examined periodically over the past 20 years both in narrative reviews and in meta-analyses.²²⁻²⁴ Recent evidence reviews by Duke University's Center for Clinical Health

Efficacy of Behavioral Treatments for Migraines

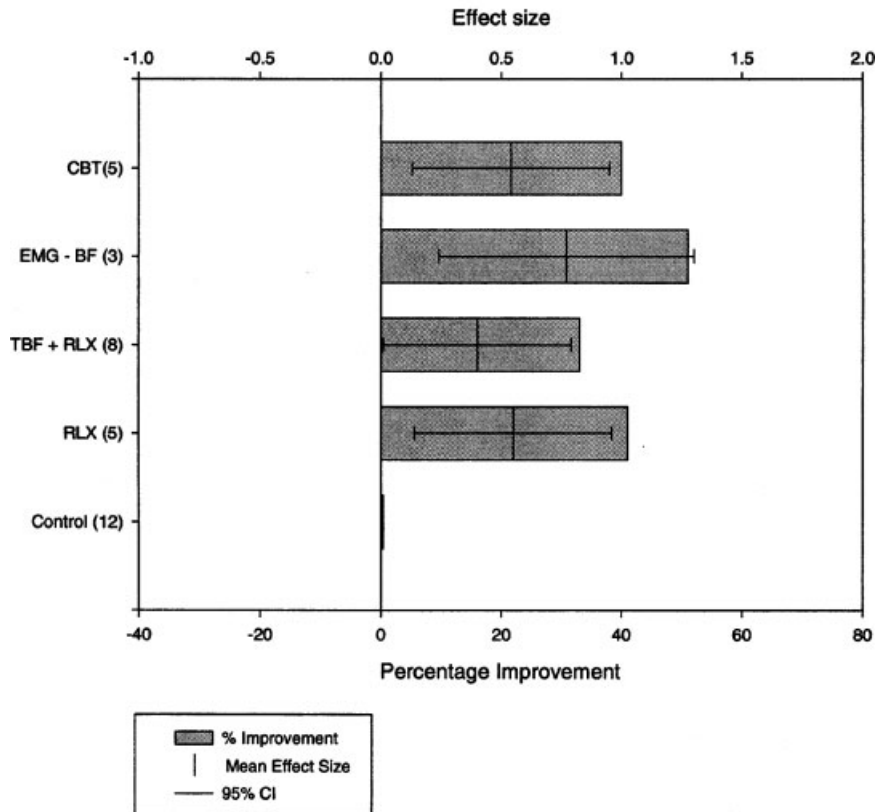


Figure 1 Effect size with 95% confidence interval (top axis) and percent reduction in migraine (bottom axis). CBT, cognitive-behavior therapy; EMG-BF, electromyographic biofeedback training; TBF + RLX, thermal biofeedback training plus relaxation training; RLX, relaxation training; control, headache monitoring control. (Adapted from Goslin R, Gray R, McCrory D. Behavioral and physical treatments for migraine headache. Technical review 2.2. Duke Center for Health Policy Research (prepared for Agency for Health Care Policy and Research). Available at: <http://www.clinpol.mc.duke.edu>. Accessed May 15, 2005.)

Policy Research, commissioned by the Agency for Health Care Research and Quality (AHRQ), have examined the efficacy of both behavioral and pharmacological treatments for migraine in adults. Fig. 1 presents the estimated effect size and percentage reduction in migraine for the four psychological treatments judged efficacious in this evidence report. The four interventions produce moderate reductions in migraine activity.

The AHRQ evidence report prompted the formation of the U.S. Headache Consortium to develop clinical guidelines for migraine management. The consortium guidelines, published in brief in *Neurology*²⁵ and in more detail on the American Academy of Neurology Web site,²⁶ conclude: "Relaxation training, thermal biofeedback combined with relaxation training, EMG biofeedback, and cognitive-behavioral therapy may be considered as treatment options for the prevention of migraine."

Pediatric

Children and adolescents appear to be more responsive than adults to behavioral treatments. Comparing results

from four ($n = 49$) pediatric and six ($n = 103$) adult trials of thermal biofeedback training, children tended to achieve better control of hand temperature (5.5% versus 3.9% increase) and larger reductions in migraine activity (62% versus 34% decrease, $P < 0.02$) than adults.²⁷ A meta-analysis of 17 trials of pediatric migraine behavioral treatments also yielded relatively large treatment effects for the four commonly used behavioral interventions: thermal biofeedback training, progressive muscle relaxation training, combined thermal biofeedback/relaxation training, and cognitive-behavioral treatment (Fig. 2).²⁸

INTEGRATING DRUG AND BEHAVIORAL TREATMENTS

Adults

In the absence of trials that directly compare drug and behavioral therapies, meta-analysis provides the best method of comparing the effectiveness of these two treatment modalities. Holroyd and colleagues²⁹ compared results reported in 25 preventive drug (propranolol

Efficacy of Behavioral Treatments for Pediatric Migraine

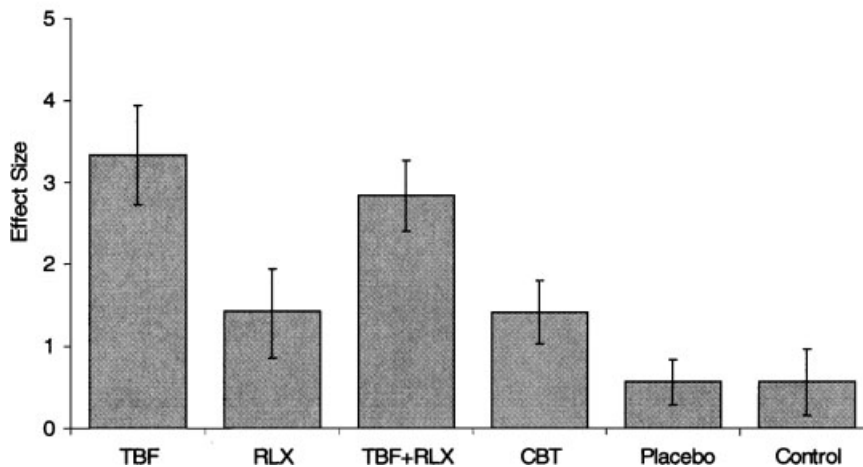


Figure 2 Within-group effect sizes (outliers removed) with 95% confidence interval. TBF, thermal biofeedback training; RLX, relaxation training; CBT, cognitive-behavior therapy. (Adapted from Hermann C, Kim M, Blanchard EB. Behavioral and pharmacological intervention studies of pediatric migraine: an exploratory meta-analysis. *Pain* 1995;60:239-256.)

HCl) therapy trials and in 35 thermal biofeedback/relaxation trials that included over 2400 patients. Nearly identical outcomes were reported with propranolol and thermal biofeedback training: each treatment yielded, on average, a 55% reduction in migraine activity, and (pill) placebo yielded only a 12% reduction in migraine activity.

Two trials also examined the benefits of combining propranolol with thermal biofeedback/relaxation training. Holroyd and colleagues³⁰ compared the effectiveness of (limited-contact) thermal biofeedback training alone and when combined with propranolol (60 to 180 mg/d). Propranolol significantly enhanced the effectiveness of thermal biofeedback training on measures of migraine activity, analgesic medication use, and quality of life. Earlier, Mathew³¹ also found that propranolol (60 to 120 mg/d) increased the effectiveness of a 10-session multimodal biofeedback training package; however, propranolol HCl alone was more effective than biofeedback training, and about as effective as the combined treatment. The high dropout rate (38%) from biofeedback training alone raises the possibility that outcomes were compromised by poor patient compliance.

Pediatric

The two trials that have directly compared behavioral and preventive drug therapies for pediatric migraine have each found behavior therapy, but not preventive drug therapy, effective in controlling migraines. One trial ($n = 43$; mean age 11 years)³² compared two behavioral treatments (stress management plus relaxation or stress management plus cephalic vasomotor biofeedback) and preventive medication (metoprolol, 50 to 100 mg/d).

Relaxation plus stress management proved more effective than either biofeedback plus stress management or metoprolol alone. Cephalic vasomotor biofeedback is difficult and children receiving this treatment did not appear to consistently learn this skill, limiting the value of this treatment. Treatment effects were also evaluated following withdrawal of metoprolol, so metoprolol results may have been different if medication had been continued.

An earlier trial ($n = 28$; ages 6 to 12 years old)³³ used an incomplete triple crossover design in a placebo-controlled comparison of the effectiveness of relaxation training with self-hypnosis and propranolol (3 mg/kg per day). The average number of migraines observed in the 3-month propranolol and placebo periods did not differ, but significantly fewer migraines were observed in the 3-month relaxation/self-hypnosis periods. Although the number of participants is small, this is clearly a negative study for propranolol; results for relaxation are qualified by the fact that this treatment cannot be withdrawn and thus was always administered in the third crossover period.

For adults with migraine, data suggests approximately equal therapeutic benefit for preventive medication and behavioral treatments with the possibility that combined treatment can enhance treatment outcomes in some instances. Direct treatment comparisons that consider differences in migraine subpopulations and/or migraine characteristics would be helpful (e.g., is there a level of headache severity for which a combined treatment of preventive medication plus behavior treatment is optimal?). In pediatric migraine, behavioral treatments (thermal biofeedback in particular) appear effective,^{28,34} although the evidence base is limited to small studies; for the most part, information is lacking on the effectiveness

of preventive medication.³⁵ Larger studies examining the separate and combined effects of behavioral migraine management and preventive medication benefits are needed.

GUIDELINES FOR BEHAVIORAL TREATMENT

Behavioral migraine management is clearly effective, with many patients reducing headache activity by 50% or more. However, one-third to one-half of behavioral treatment patients do not achieve such success,^{36,37} raising the question, for whom are behavioral interventions effective? In the past decade, there has been increased attention on developing treatment guidelines for migraine headache, and in turn, increased focus on integrating behavioral techniques into such guidelines. Researchers have called for studies relevant to the development of treatment algorithms identifying who would benefit from behavioral intervention and under what circumstances.

Lipton and his colleagues^{38,39} have suggested that migraine treatment should follow a format of stratified care in which initial treatment is based on a patient's headache severity, disability, or other mitigating factors, including suitability or preference for behavior treatment, rather than starting at the base of a "therapeutic pyramid" and moving upward until an effective treatment is found. Within stratified care, behavior management of migraine might be considered as an initial treatment for patients with a preference for nonpharmacological treatments, those with a history of poor tolerance or contraindication for medication, patients who are pregnant, nursing, or planning a pregnancy, or those with a history of acute medication overuse.⁴⁰ Such an algorithm should also include "rule-outs" for behavior treatment. A rule-out might include complications that suggest medical reevaluation, reading comprehension below 8th grade for limited-contact treatment, and cognitive impairment or comorbid psychiatric disorder of sufficient severity to impair the patient's ability to participate in treatment.⁴¹

An algorithm for integrating behavioral and drug therapies has been proposed that uses headache frequency as a starting point in choosing medication, behavioral therapy, or a combination of the two.⁴² This algorithm uses questions about patient preferences, adherence to and tolerance for medication, and ability to learn and use behavior skills to assist health care professionals navigate treatment options. Evaluation of the clinical utility of such an algorithm and further specification of decision rules would be valuable.

Empirical determination of therapeutic decision points requires outcome research across headache subpopulations (e.g., refractory headache, medication overuse headache, depressed patients) as well as prospective

studies examining predictors of treatment success and failure. Relevant data are limited, but a brief review of predictors of treatment response with adult and pediatric migraine is summarized below.

Adult Migraine

AGE

In a review of age effects in behavior treatment it is noted that early studies, including a meta-analytic review of 37 studies,⁴³ suggested older adults showed a poor response to behavioral treatments. However, subsequent prospective studies that adjusted treatment procedures to accommodate older adults (e.g., more detailed explanations and reviews of material, more practice time before introducing advanced skills) have reported more positive outcomes.⁴⁴ It thus appears that older adults can benefit from relatively simple modifications of clinic-based behavioral treatments.

PSYCHOLOGICAL SYMPTOMS

Depression and anxiety are comorbid with migraine (see Radat and Swendsen⁴⁵ for review) but no studies have examined the impact of major depressive disorder on behavioral treatment outcome. Clinicians generally agree that when depression is severe, behavioral treatment will be difficult and, further, that addressing the mood disorder through psychological and/or drug therapy (if possible therapies that also are effective with migraine) should be the primary goal. Although migraine is comorbid with mood and anxiety disorders, most individuals with migraine do not have an anxiety or mood disorder. If a psychiatric disorder is suspected, a brief diagnostic evaluation, such as that provided by the PrimeMD,⁴⁶ can be helpful.

REFRACTORY HEADACHES

Patients with headaches that have proven refractory to multiple treatments present an obvious treatment challenge. Andrasik⁴⁷ reviews the handful of studies that have added behavior treatment to drug therapy with refractory headaches, concluding that the addition of behavioral interventions can help patients who have not responded to single modality treatment. For example, a study that examined an interdisciplinary group treatment approach (medication management, physical therapy, education, relaxation, and biofeedback) for previously intractable headache found that more than 70% of patients experienced a 50% or better reduction in headaches; further, there was an average reduction in medication use of 71%.⁵

MEDICATION OVERUSE

As might be expected, medication overuse headache is less responsive than migraine to behavioral treatment.

The acute headaches experienced during medication withdrawal initially can make behavior interventions difficult; patients suffer physically as they wean off medication and they are not yet experienced in how to effectively use behavior skills to help them cope.

There is evidence that, in combination with a medication withdrawal program, behavioral interventions can be helpful in the long-term management of medication withdrawal headaches. Grazi and colleagues⁴⁸ examined the benefit of incorporating biofeedback into an inpatient medication withdrawal program for patients with transformed migraine complicated by analgesic overuse. All patients received a standard drug detoxification and drug prophylaxis during a 10-day inpatient stay; half were randomized to also receive eight weekly biofeedback-assisted relaxation training sessions beginning in the hospital and continuing after discharge. Immediately following treatment and for 1-year follow-up, similar levels of improvement were observed across the two groups; however, by 3 years the behavioral treatment group recorded fewer days of headache and reduced use of analgesics compared with the drug-alone group. Further, there was greater relapse in the drug group (42.1%) compared with the combination group (12.5%). Although this study is limited by its quasirandomized design (a few patients who lived far from the clinic were allowed to decline biofeedback treatment) and the lack of intent-to-treat analyses, it suggests behavioral interventions may help prevent relapse, possibly by providing an alternative to acute medication use during periods of headache exacerbations.

Pediatric Migraine

Factors that predict response to behavioral treatments for pediatric migraine have rarely been examined. Hermann and colleagues⁴⁹ examined psychosocial predictors of response to limited-contact biofeedback treatment training administered to 32 children aged 8 to 16 years. Externalizing behavioral tendencies, a higher initial level of psychosomatic complaints, and younger age were predictive of positive outcome, accounting for 39% of treatment success. No relationship between gender or headache chronicity and treatment outcome were observed. In contrast, across two studies Osterhaus and colleagues^{50,51} found that greater migraine chronicity was associated with a poorer response to combined biofeedback and cognitive-behavioral therapy in adolescents (ages 12 to 17). Conclusions about demographic, headache, and psychosocial predictors of response to behavioral treatment clearly require additional studies.

Health care professionals experience firsthand the fundamental fact that all treatments do not work the

same for all patients. It is incumbent upon migraine researchers to develop guidelines that will assist in the selection of appropriate, effective treatments for individual migraine patients.

CONCLUSION

Increasingly, researchers are seeking ways of making behavioral treatments for migraine available to individuals who do not receive treatment due to the expense of treatment, inability to travel to clinic, dislike of or contraindication to medication use, or frustration with past treatment. Promising treatment venues include limited-contact and home-based treatment formats, as well as delivery of treatments in schools and work sites or via the Internet and other mass media. Such public health applications of behavioral interventions have the potential to reach a large proportion of migraine sufferers who do not currently receive treatment, and thus might have important effects on migraine treatment at a population level. However, any intervention can also have negative effects so better information is needed about long-term effects of participation in such community programs.

ACKNOWLEDGMENTS

Support for this review was provided, in part, by a grant from The National Institute of Neurological Disorders and Stroke of the National Institutes of Health (NINDS #NS32374).

REFERENCES

1. Schwartz MS, Andrasik F. Biofeedback: A Practitioner's Guide. 3rd ed. New York: Guilford Press; 2003
2. Holroyd KA, Lipchik GL, Penzien DB. Behavioral management of recurrent headache disorders. In: Silberstein SD, Lipton RB, Dalessio DJ, eds. Wolff's Headache and Other Headache Pain. 7th ed. New York: Oxford University Press; 2001:562-598
3. Lipchik GL, Holroyd KA, Nash JM. Cognitive-behavioral management of recurrent headache disorders: a minimal-therapist contact approach. In: Turk DC, Gatchel RS, eds. Psychological Approaches to Pain Management. 2nd ed. New York: Guilford Press; 2002:356-389
4. Blanchard EB, Andrasik F. Management of Chronic Headaches: A Psychological Approach. Elmsford, NY: Pergamon Press; 1985
5. Scharff L, Marcus DA. Interdisciplinary outpatient group treatment of intractable headache. *Headache* 1994;34:73-78
6. Richardson GM, McGrath PJ. Cognitive-behavioral therapy for migraine headaches: a minimal-therapist-contact approach versus a clinic-based approach. *Headache* 1989; 29:352-357
7. Teders SJ, Blanchard EB, Andrasik F, Jurish SE, Neff DF, Arena JG. Relaxation training for tension headache:

- comparative efficacy and cost-effectiveness of a minimal therapist contact versus a therapist delivered procedure. *Behav Ther* 1984;15:59-70
8. Jurish SE, Blanchard EB, Andrasik F, Teders SJ, Neff DF, Arena JG. Home- versus clinic-based treatment of vascular headache. *J Consult Clin Psychol* 1983;51:743-751
 9. Haddock CK, Rowan AB, Andrasik F, Wilson PG, Talcott GW, Stein RJ. Home-based behavioral treatments for chronic benign headache: a meta-analysis of controlled trials. *Cephalalgia* 1997;17:113-118
 10. McGrath PJ, Humphreys P, Keene D, et al. The efficacy and efficiency of a self-administered treatment for adolescent migraine. *Pain* 1992;49:321-324
 11. Cottrell C, Drew JB, Waller SE, Holroyd KA, Brose JA, O'Donnell FJ. Perceptions and needs of patients with migraine. *J Fam Pract* 2002;51:142-147
 12. Connelly M, Rapoff MA, Thompson N, Connelly W. Headstrong: a pilot study of a CD-ROM intervention for recurrent pediatric headache. *J Pediatr Psychol* 2006;31:1-11
 13. Cottrell C, Drew J, Gibson J, Holroyd K, O'Donnell F. Telephone administered behavioral treatment of adolescent migraine. *Headache*. In press
 14. Larsson B, Carlsson J, Fichtel A, Melin L. Relaxation treatment of adolescent headache sufferers: results from a school based replication series. *Headache* 2005;45:692-704
 15. Stewart W, Ricci JA, Chee E, Morganstein D, Lipton R. Lost productive time and cost due to common pain conditions in the U.S. workforce. *JAMA* 2003;290:2443-2454
 16. Schneider WJ, Furth PA, Blalock TH, Sherrill TA. A pilot study of a headache program in the workplace: the effect of education. *J Occup Environ Med* 1999;41:202-209
 17. Strom L, Peterson R, Andersson G. A controlled trial of self-help treatment of recurrent headache conducted via the internet. *J Consult Clin Psychol* 2000;68:722-727
 18. Andersson G, Lundstrom P, Strom L. A controlled trial of self-help treatment of recurrent headache conducted via the internet. *Headache* 2003;43:353-361
 19. Devineni T, Blanchard EB. A randomized controlled trial of an internet-based treatment for chronic headache. *Behav Res Ther* 2005;43:277-292
 20. Hicks C, von Baeyer C, McGrath P. Online psychological treatment for pediatric recurrent pain: a randomized evaluation. *J Pediatr Psychol*. In press
 21. de Bruijn-Kofman AT, van de Wiel H, Groenman NH, Sorbi MJ, Klip E. Effects of a mass media behavioral treatment for chronic headache: a pilot study. *Headache* 1997;37:415-420
 22. Blanchard EB, Andrasik F, Ahles TA, Teders SJ, O'Keefe DM. Migraine and tension headache: a meta-analytic review. *Behav Ther* 1980;11:613-631
 23. Blanchard EB. Psychological treatment of benign headache disorders. *J Consult Clin Psychol* 1992;60:537-551
 24. Holroyd KA. Management of migraine and tension-type headaches. In: Trafton J, ed. *Best Practices in the Behavioral Management of Chronic Disease: Neuropsychiatric Disorders*. Vol. 1. Los Altos, CA: Institute for Disease Management; 2003
 25. Silberstein S, Rosenberg J. Multispecialty consensus on diagnosis and treatment of headache. *Neurology* 2000;54:1553-1554
 26. Campbell JK, Penzien DB, Wall EM. Evidence-based guidelines for migraine headache: behavioral and physical treatments. U.S. Headache Consortium. Available at: <http://www.aan.com/public/practiceguidelines/headache.htm>. Accessed May 15, 2005
 27. Sarafino E, Goehring P. Age comparisons in acquiring biofeedback control and success in reducing headache pain. *Ann Behav Med* 2000;22:10-16
 28. Hermann C, Kim M, Blanchard EB. Behavioral and pharmacological intervention studies of pediatric migraine: an exploratory meta-analysis. *Pain* 1995;60:239-256
 29. Holroyd KA, Penzien DD, Cordingley G. Propranolol in the management of recurrent migraine: a meta-analytic review. *Headache* 1991;31:333-340
 30. Holroyd KA, France JL, Cordingley GE, et al. Enhancing the effectiveness of relaxation/thermal biofeedback training with propranolol HCl. *J Consult Clin Psychol* 1995;63:327-330
 31. Mathew NT. Prophylaxis of migraine and mixed headache: a randomized controlled study. *Headache* 1981;21:105-109
 32. Sartory G, Muller B, Metsch J, Pothmann R. A comparison of psychological and pharmacological treatment of pediatric migraine. *Behav Res Ther* 1998;36:1155-1170
 33. Olness K, MacDonald JT, Uden DL. Comparison of self-hypnosis and propranolol in the treatment of juvenile migraine. *Pediatrics* 1987;79:593-597
 34. Holden EW, Deichmann MM, Levy JD. Empirically supported treatments in pediatric psychology: recurrent pediatric headache. *J Pediatr Psychol* 1999;24:91-109
 35. Lewis D, Ashwal S, Hershey A, Hirtz D, Yonker M, Silberstein S. Practice parameter: pharmacological treatment of migraine headache in children and adolescents. *Neurology* 2004;63:2215-2224
 36. Penzien DB, Rains JC, Andrasik F. Behavioral management of recurrent headache: three decades of experience and empiricism. *Appl Psychophysiol Biofeedback* 2002;27:163-181
 37. Holroyd KA. Assessment and psychological management of recurrent headache disorders. *J Consult Clin Psychol* 2002;70:656-677
 38. Lipton RB, Stewart W, Stone A, Lainez M, Sawyer J. Stratified care vs step care strategies for migraine: the Disability in Strategies of Care (DISC) study: a randomized trial. *JAMA* 2000;284:2599-2605
 39. Lipton R. Disability assessment as a basis for stratified care. *Cephalalgia* 1998;18(suppl 22):40-46
 40. Lipton RB, Bigal ME, Stewart WF. Disease management of migraine and the importance of stratified care. *Dis Manage Health Outcomes* 2003;11:379-388
 41. Holroyd KA, Penzien DB. Psychosocial interventions in the management of recurrent headache disorders. 1: overview and effectiveness. *Behav Med* 1994;20:53-63
 42. Holroyd KA, Lipchik GL, Penzien DB. Psychological management of recurrent headache disorders: empirical basis for clinical practice. In: Dobson KS, Craig KD, eds. *Best Practice: Developing and Promoting Empirically Supported Interventions*. Newbury Park, CA: Sage; 1998:193-212
 43. Holroyd KA, Penzien DB. Client variables in the behavioral treatment of recurrent tension headache: a meta-analytic review. *J Behav Med* 1986;9:515-536
 44. Mosley TH, Grotheus CA, Meeks WM. Treatment of tension headache in the elderly: a controlled evaluation of relaxation training and relaxation combined with cognitive-behavior therapy. *J Clin Geropsychol* 1995;1:175-188
 45. Radat F, Swendsen J. Psychiatric comorbidity in migraine: a review. *Cephalalgia* 2005;25:165-178
 46. Spitzer RL, Williams JBW, Kroenke K, et al. Utility of a new procedure for diagnosing mental disorders in primary care: the PRIME MD 1000 study. *JAMA* 1994;272:1749-1756

47. Andrasik F. Behavioral treatment approaches to chronic headache. *Neurol Sci* 2003;24:S80-S85
48. Grazi L, Andrasik F, D'Amico D, et al. Behavioral and pharmacologic treatment of transformed migraine with analgesic overuse: outcome at 3 years. *Headache* 2002;42:483-490
49. Hermann C, Blanchard EB, Flor H. Biofeedback treatment for pediatric migraine: prediction of treatment outcome. *J Consult Clin Psychol* 1997;65:611-616
50. Osterhaus S, Lange A, Linssen WHJP, Passchier J. A behavioral treatment of young migrainous and nonmigrainous headache patients: prediction of treatment success. *Int J Behav Med* 1997;4:378-396
51. Osterhaus SOL, Passchier J, van der Helm-Hylkema H, et al. Effects of behavioral psychophysiological treatment on schoolchildren with migraine in a nonclinical setting: predictors and process variables. *J Pediatr Psychol* 1993;18:697-715