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Behavioral Management of Recurrent Headache: Three Decades of Experience and Empiricism

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In the past three decades, behavioral interventions (chiefly relaxation, biofeedback, and stress-management) have become standard components of the armamentarium for management of migraine and tension-type headaches. Meta-analytic literature reviews of these behavioral interventions have consistently identified clinically significant reductions in recurrent headache. Across studies, behavioral interventions have yielded approximately 35–50% reduction in migraine and tension-type headache activity. Although we have only recently begun to directly compare standard drug and nondrug treatments for headache, the available evidence suggests that the level of headache improvement with behavioral interventions may rival those obtained with widely used pharmacologic therapies in representative patient samples. In recent years, some attempts have been made to increase the availability and cost effectiveness of behavioral interventions through alternative delivery formats and mass communications. Recent developments within diagnosis and classification are summarized, pointing out implications for behavioral researchers. Select future directions are discussed, which include impact of the triptans, cost and cost effectiveness, and integration of behavioral treatments into primary care settings, the place where the great majority of headache sufferers receive treatment.

KEY WORDS: tension-type headache; migraine headache; behavioral treatment; biofeedback; relaxation; stress-management; meta-analysis; primary care.

Headache is the most common pain-related complaint and the seventh leading ailment seen in medical practice, accounting for 18 million physician visits a year in the U.S. (Ries, 1986). Migraine, tension-type, and their variants are the headache types most likely to be seen at headache specialty clinics (Sanin, Mathew, Bellmeyer, & Ali, 1994), and these headache types accordingly are the main focus of this review. Well over one third of the population is affected by tension-type headache each year, and between 2 and 3% of the population suffer from chronic tension-type headache (Jensen, 1999; Schwartz, Stewart,

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Simon, & Lipton, 1998). Migraine headache is a common condition as well, with 1-year prevalence rates between 12 and 14% being reported for the United States (R. E. Sheffield, 1998). Both forms vary by race, gender, and age, with prevalence peaking in the third and fourth decades. Migraine is 3.3 times more common in women than men (Lipton, Diamond, Reed, Diamond, & Stewart, 2001; R. E. Sheffield, 1998; Silberstein & Merriam, 1991; Uknis & Silberstein, 1991). Caucasians report a higher incidence of both forms of headache than do African Americans for females and males alike (Lipton et al., 2001; Schwartz et al., 1998).

The impact of chronic headache can be described in individual, public health, and economic terms. One measure of impact is the sheer number of individuals afflicted with the disorder, and it has been estimated that 45 million Americans suffer chronic or recurring headaches (Diamond & Freitag, 1989). Migraine headache sufferers are frequently disabled during their acute attacks. In a recent study of migraineurs (Lipton et al., 2001), 90% reported functional impairment with their headaches, 53% exhibited impairment severe enough to require bed rest, nearly a third had missed at least 1 day of work or school in the 3 months preceding the survey, and 51% reported productivity was reduced by at least half because of headache. Household, family, and social activities were even more often disrupted than work.

Prevalence and impact elevate migraine to a major public health concern. In the United States, migraine results in 112 million bedridden days each year (Hu, Markson, Lipton, Stewart, & Berger, 1999). The cost of migraine to the total American workforce would be an estimated $13 billion a year in missed workdays and lost productivity. Direct medical costs (i.e., physician office visits, prescription medication claims, hospitalizations) for migraine care average $1 billion annually. Notably, migraineurs generate twice the medical claims and two times the pharmacy claims as other comparable patients without migraine in a health maintenance organization (Clouse & Osterhaus, 1994). Although epidemiological research has demonstrated that migraine is certainly one of the most common disabling pain conditions and that women are disproportionately affected, migraine has been largely overlooked in most women's health initiatives to date perhaps in favor of health issues that decrease life expectancy (Rains, Penzien, & Martin, 2002).

Compared to migraine, much less is known about the psychosocial impact of tension-type headache. In a recent epidemiologic study conducted in the U.S. 8.3% of episodic tension-type headache sufferers reported lost workdays (average 9 days per year) and 43.6% reported reduced effectiveness at work, home, and school because of headache (Schwartz et al., 1998). For those with chronic tension-type headache, 11.8% lost workdays (average 20 days per year) and 46.5% reported reduced productivity because of headache. When one considers the vast number of individuals with episodic and chronic tension-type headache, the societal impact of lost workdays and decreased productivity would be immense, probably rivaling that of migraine. Taken collectively, it becomes apparent that chronic headache is a formidable disorder.

Pharmacologic therapies have long been the most common and widely used method for treating headaches, and there are a host of highly effective medications for treating migraine and tension-type headaches (Gray et al., 1999; Gray, McCrory, Eberlein, Westman, & Hasselblad, 1999; McCrory, Matchar, Gray, Rosenberg, & Silberstein, 2000; Silberstein, 2000; Silberstein & Lipton, 2001). Unfortunately, pharmacologic treatments prove ineffective, inadequate, or inappropriate for a sizable number of patients, accounting in part

for the steadily increasing interest in behavioral approaches. In the sections to follow we review empirical support for behavioral treatments, both alone and in comparison to pharmacological treatments; summarize research that is exploring alternative ways to administer behavioral treatments; discuss modifications that have been made with respect to headache diagnosis and classification, pointing out those that may be of particular relevance for behavioral researchers, and identify a few of the additional topics that are likely to occupy much of the attention of behavioral researchers in the foreseeable future.

BEHAVIORAL MANAGEMENT OF HEADACHE: EMPIRICAL REVIEWS OF THE LITERATURE

A decade after the publication of the earliest studies evaluating behavioral treatments for headache (Budzynski, Stoyva, & Adler, 1970; Hay & Madders, 1971; Mitchell, 1969; Sargent, Green, & Walters, 1972) there were already a sufficient number of empirical papers to allow Blanchard, Andrasik, and colleagues to undertake a meta-analytic review of the scientific literature evaluating behavioral treatments for both migraine and tension headaches (Blanchard, Andrasik, Ahles, Teders, & O'Keefe, 1980). These researchers were among the first to employ techniques of meta-analysis within the domain of behavioral medicine, and they did so at a time when meta-analysis itself was in its infancy and still a highly controversial methodology (Glass, 1976; Smith & Glass, 1977). Despite the early controversy and criticisms over the "inappropriate aggregation of data from across studies," meta-analytic techniques have been lauded for quantifying and thereby making explicit large quantities of information and the assumptions underlying their cumulation and analysis. Today meta-analysis is considered "mainstream" and a vital element in the trend toward evidence-based medicine and clinical guidelines. While Blanchard et al. identified a total of 16 behavioral treatment studies in 1980 for their first empirical review (Blanchard et al., 1980), just a few years later Holroyd and Penzien (1986) identified 37 studies of behavioral treatment for tension headache alone, and by 1999 Goslin and colleagues identified over 300 studies with at least one behavioral treatment condition (Goslin et al., 1999).

Another strength of the meta-analytic approach is that different reviewers can employ differing inclusion/exclusion criteria for their respective reviews. The majority of empirical reviews of the headache literature have adopted the strategy of including data from all available treatment studies regardless of the experimental design (e.g., single group outcome study vs. controlled trial) or the publication status (i.e., published vs. unpublished). However, the most recent meta-analyses have included only the most carefully designed and reported trials and thus selectively included only trials that were randomized and controlled. Clearly, each of these analytic strategies has its merits. In the sections that follow, we describe the most comprehensive empirical reviews of both types.

Behavioral Management of Migraine

In February 1999, the U.S. Agency for Healthcare Research and Quality (AHRQ) released a series of technical reports that consisted of systematic reviews of all controlled trials of pharmacological, behavioral, and physical treatments for migraine that were published between 1966 and 1996 (reports available online at http://www.clinpol.mc.duke.edu/). The

technical report of most relevance here provided a meta-analysis of behavioral treatments for migraine (Goslin et al., 1999). The exhaustive literature search identified 355 articles describing behavioral and physical treatments for migraine, of which 70 reported controlled clinical trials of behavioral treatments for migraine in adults. The 39 prospective and randomized trials that met all of the stringent research design and data extraction requirements yielded the following 60 treatment groups: relaxation training (RLX, 10 trials), temperature biofeedback training (Temp. BF, 5 trials), temperature biofeedback plus relaxation training (Temp. BF + RLX, 10 trials), EMG biofeedback training (EMG BF, 5 trials), cognitive-behavioral therapy (stress-management training; CBT, 7 trials), cognitive-behavioral therapy plus temperature biofeedback (CBT + Temp. BF, 5 trials), hypnotherapy (2 trials), wait list control (12 trials), and other controls (4 trials). Based on composite headache index or headache frequency measures, treatment outcome data were calculated using two metrics: (a) summary "effect size estimates," or the standardized difference between group means, and (b) average percentage improvement from pre- to posttreatment (weighted by sample size). These behavioral interventions yielded 32–49% reduction in migraine versus 5% reduction for no-treatment controls (see Fig. 1). The conservative effect size estimates indicated that relaxation training, thermal biofeedback combined with relaxation training, electromyographic biofeedback, and cognitive-behavioral therapy were all statistically more effective than wait list control.

An important evidence-based guideline based on the AHRQ technical reviews of the evidence has now been forwarded by a multidisciplinary consortium (U.S. Headache Consortium; McCrory et al., 2000; Silberstein, 2000). Consortium members included the American

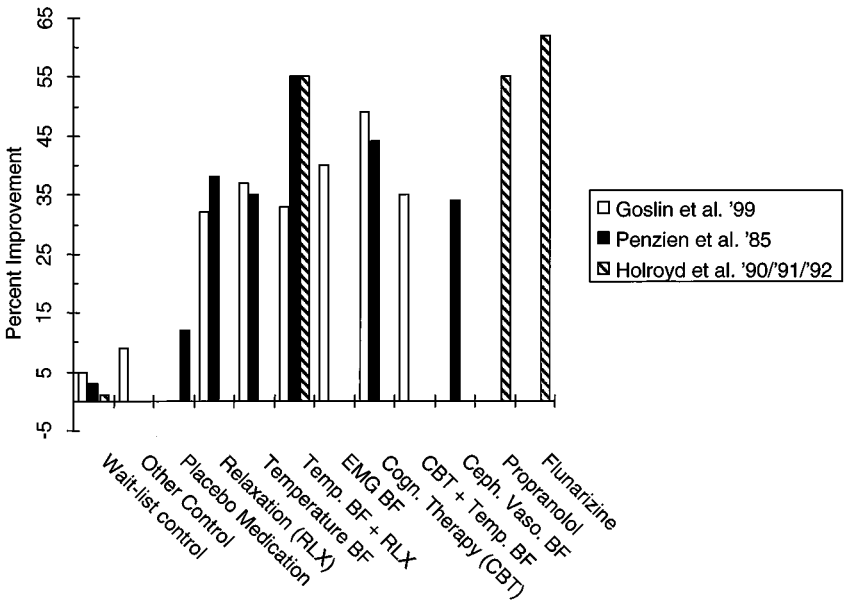

Fig. 1. Combined meta-analyses of behavioral and pharmacological treatments for migraine: Percent improvement scores by treatment condition. Abbreviations: RLX = Relaxation Training; CBT = Cognitive-Behavioral Therapy; Ceph. Vaso. BF = Cephalic Vasomotor Biofeedback Training; Temp. BF = Temperature Biofeedback Training; EMG BF = EMG Biofeedback Training.

Academy of Family Physicians, American Academy of Neurology, American Headache Society, American College of Emergency Physicians, American College of Physicians, American Osteopathic Association, and the National Headache Foundation. Focused on management of migraine by the primary care practitioner, the guideline is available on-line in its entirety (http://www.aan.com/). The Consortium's recommendations pertaining to behavioral interventions for migraine are as follows: (a) relaxation training, thermal biofeedback combined with relaxation training, electromyographic biofeedback, and cognitive-behavioral therapy may be considered as treatment options for prevention of migraine (Grade A Evidence), and (b) behavioral therapy may be combined with preventive drug therapy to achieve added clinical improvement for migraine (Grade B Evidence; Campbell, Penzien, & Wall, 2000). The Consortium also drew the following conclusions: (a) too few studies provide head-to-head comparisons of nondrug and drug treatments, (b) the integration of drug and nondrug treatments is not adequately addressed, (c) behavioral therapies are effective as sole or adjunctive therapy, but it is not yet established which specific patients are likely to be most responsive to specific behavioral modalities, (d) component analysis is needed to determine the extent to which various elements of multimodal regimens contribute to efficacy, and (e) additional studies treating patients from primary care settings are needed. These conclusions will no doubt serve as one important guide and springboard for future research efforts.

Finally, The U.S. Headache Consortium concluded that behavioral treatments may be particularly well suited for patients having one or more of the following characteristics: the patient prefers such an approach; pharmacological treatment cannot be tolerated or is medically contraindicated; the response to pharmacological treatment is absent or minimal; the patient is pregnant, has plans to become pregnant, or is nursing; the patient has a long-standing history of frequent or excessive use of analgesic or acute medications that can aggravate headache; or the patient is faced with significant stressors or has deficient stress-coping skills.

While the meta-analysis by Goslin et al. (1999) employed highly selective study inclusion criteria, all other migraine meta-analyses have been broadly inclusive of all available research (e.g., Blanchard et al., 1980; Blanchard & Andrasik, 1982, 1987; Holroyd & Penzien, 1990; Penzien, Holroyd, Holm, & Hursey, 1985). Although space limitations do not permit us to address each review, all of the meta-analyses conducted to date have reported findings that closely parallel the more selective review by Goslin et al. (1999): behavioral treatments for migraine are efficacious (typically 30–55% headache reduction from pre- to posttreatment), and most treatment conditions statistically are more effective than control conditions (see Fig. 1).

The comparative efficacy of pharmacologic versus behavioral therapies for migraine has only rarely been directly assessed (Holroyd et al., 1988; Mathew, 1981; Penzien, Johnson, Carpenter, & Holroyd, 1990; Sovak, Kunzel, Sternbach, & Dalessio, 1981). However, in the available meta-analyses virtually identical improvement in migraine has been reported with propranolol (arguably the preventive pharmacologic therapy most widely employed in the Unite States and among the most effective for migraine; 32 trials), flunarizine (a calcium channel blocker widely used for migraine prophylaxis in Canada and Europe; 31 trials), and combined relaxation and biofeedback training (35 trials; Davis, Holroyd, & Penzien, 1999; Holroyd & Penzien, 1990; Holroyd, Penzien, Rokicki, & Cordingley, 1992). Patients receiving placebo pills for migraine showed only a 12% improvement on average (see Fig. 1; Holroyd, Penzien, & Cordingley, 1991). Thus, the best of the preventive

pharmacologic and behavioral therapies appear to be equally viable for uncomplicated or "garden variety" migraine patients.

Behavioral Management of Tension-Type Headache

With funding from the AHRQ and the Foundation for Chiropractic Education and Research, an exhaustive meta-analysis of behavioral treatments for tension-type headache was recently completed (McCrory, Penzien, Hasselblad, & Gray, 2001). The methods adopted by McCrory and colleagues closely paralleled the Goslin et al. (1999) review of the migraine literature in that this analysis employed stringent research design and data extraction requirements and selectively included only randomized, controlled trials. McCrory and colleagues' literature search identified 107 articles describing behavioral treatments for tension-type headache published between 1966 and 1999 (McCrory et al., 2001). The 35 prospective and randomized trials that met all of the stringent research design and data extraction requirements yielded the following 77 treatment groups: relaxation training (RLX, 19 trials), EMG biofeedback training (EMG BF, 14 trials), EMG biofeedback plus relaxation training (EMG BF + RLX, 7 trials), cognitive-behavioral therapy (stress-management training; CBT, 13 trials), wait list control (13 trials), and other controls (11 trials). For comparison purposes, McCrory and colleagues also searched for all controlled trials of amitriptyline, arguably the most commonly prescribed medication for prophylaxis of tension-type headache, and they were surprised to learn that only three such trials could be identified in the published literature. As in the Goslin et al. (1999) review, treatment outcome data were calculated using two metrics: summary effect size estimates and average percentage improvement from pre- to posttreatment. Behavioral interventions for tension-type headache yielded 37–50% reduction in headache versus 2% reduction for no-treatment, and 9% for other controls (see Fig. 2). The effect size estimates indicated that all of the behavioral interventions statistically were more effective than wait list control.

The meta-analysis by McCrory et al. (2001) is the only one to employ highly selective study inclusion criteria for tension-type headache (similar to Goslin et al., 1999, for migraine). All other meta-analyses of the tension-type literature have been broadly inclusive of all available research (e.g., Blanchard et al., 1980; Bogaards & terKuile, 1994; Holroyd & Penzien, 1986). These other meta-analyses have reported findings that closely parallel the McCrory et al. (2001) review: behavioral treatments for tension-type headache are efficacious (typically 35–55% headache reduction from pre- to posttreatment), and all treatment conditions statistically are more effective than control conditions (see Fig. 2).

Even less evidence is available to address the comparative efficacy of pharmacologic versus behavioral therapies for tension-type than for migraine headache (Bruhn, Olesen, & Melgaard, 1979; Holroyd, Nash, Pingel, Cordingley, & Jerome, 1991; Holroyd, O'Donnell, et al., 2001; Reich & Gottesman, 1993). Because relatively few trials of medication prophylaxis for tension-type headache have been published to date, even meta-analytic techniques cannot shed much additional light on this issue. The three controlled studies of amitriptyline for tension-type headache reviewed by McCrory et al. (2001) have yielded, on average, a 33% reduction in headache activity, which is on the low end of the range achieved by behavioral therapies (see Fig. 2). Perhaps the best available evidence addressing this issue is provided by the study of Holroyd, O'Donnell, et al. (2001) which randomly assigned over 200 tension-type headache patients to one of four conditions: (a) tricyclic

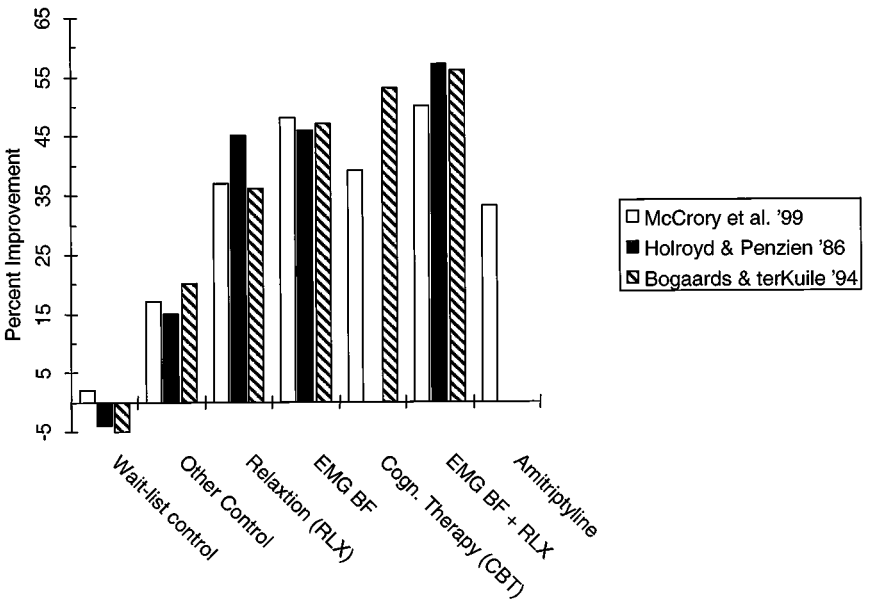

Fig. 2. Combined meta-analyses of behavioral and pharmacological treatments for tension-type headache: Percent improvement scores by treatment condition.

antidepressant medication, (b) stress-management training, (c) combined antidepressant and stress-management, or (d) medication placebo. Medication and behavioral therapy each produced larger reductions in headache activity, analgesic medication use, and headache-related disability than that by placebo, but the medication condition yielded more rapid improvements in headache activity. The combined therapy was more likely to produce clinically meaningful reductions in headache (64% of patients) than either antidepressant medication (38%) or stress management training (35%); although both treatment strategies are modestly effective, the combined therapy may improve outcomes.

While behavioral treatments target both the frequency and the severity of headaches, in most instances these interventions emphasize *prevention* of headache episodes as opposed to alleviation of suffering of acute headache episodes. Although behavioral modalities can be highly effective as monotherapy, they are more commonly used in conjunction with pharmacological management. Often, patients who undergo behavioral treatment for headache also show concomitant reductions in psychological symptoms, distress, or other somatic complaints. For some patients, these latter benefits may be appreciated as much or more than reductions in headache activity (Penzien, Rains, & Holroyd, 1993).

Maintenance of Treatment Gains and Predicting Treatment Response

There is a sizeable amount of evidence indicating that, at least among those who respond initially, the effects of behavioral treatments endure over time, with the longest followup occurring after 7 years (see Blanchard, 1992). These effects are maintained whether further contact is provided (booster sessions) or not (Andrasik, Blanchard, Neff, & Rodichok, 1984). For example, Blanchard, Appelbaum, Guarnieri, Morrill, and Dentinger (1987) found

that 78% of tension-type sufferers and 91% of migraine sufferers remained significantly improved 5 years following behavioral treatment. A retrospective examination of nearly 400 headache patients who completed a comprehensive treatment program that included relaxation and biofeedback found that 65% reported maintaining their treatment gains (Diamond & Montrose, 1984). Although retrospective, these results are presented here because of the large sample size and the fact that the data were collected within a clinical program (versus the more typical research program) and, as such, may address the issue of "effectiveness" (vs. "efficacy").

Available research is helping to define who does and who does not respond well to standard behavioral treatments. Individuals experiencing cluster (Blanchard, Andrasik, Jurish, & Teders, 1982), posttraumatic (Ramadan & Keidel, 2000), drug-induced (see earlier discussion), unremitting (see earlier discussion), and possibly menstrual migraine (see Holroyd, Penzien, & Lipchik, 2001) headaches respond less well. For some of these patients, coordinated, interdisciplinary care, such as that found at most comprehensive pain centers, may be required (Duckro, Tait, Margolis, & Silvermintz, 1985; Lake, Saper, Madden, & Kreeger, 1993). Children respond at a greater level (see article by Hermann & Blanchard, this issue) and elderly patients can respond at levels reported in the earlier described meta-analyses if certain procedural adjustments are made to accommodate for any physical or cognitive limitations present (see article by Middaugh & Pawlick, this issue). (See Andrasik, 2001, Andrasik & Flor, in press, Andrasik & Walch, in press, and Holroyd, Penzien, et al., 2001, for more complete discussions of these topics and other aspects of behavioral assessment and treatment of recurrent headaches).

ALTERNATE TREATMENT FORMATS FOR BEHAVIORAL INTERVENTIONS

Minimal Therapist-Contact Treatment

In the 1980s, researchers became increasingly aware of drawbacks to the sole pursuit of intensive 1:1 treatment delivery models and began to consider issues of cost and efficiency. Inducements for the development of this treatment strategy have included concerns over increasing health care costs, stricter standards for third party reimbursement, and limited access to health care professionals (particularly in rural areas). Minimal therapist-contact or "home-based" treatments were developed as one alternative. There are a number of potential advantages to such an approach, with possibly few potential disadvantages (Andrasik, 1996).

In a minimal-contact treatment format, self-regulation skills are introduced in the clinic, but training primarily occurs at home with the patient being guided by written materials and audiotapes. Consequently, only three or four clinic sessions may be necessary when behavioral techniques are delivered via this format, whereas eight or more (often as many as 12–16 weekly sessions) clinic sessions may be required when treatment is administered in the standard format. Three meta-analyses of minimal-contact behavioral interventions for headache have consistently demonstrated the utility of the minimal-contact treatment approach, indicating that for many patients such treatments can be as effective as those delivered in a clinic setting (Haddock et al., 1996; Penzien, Rains, & Holroyd, 1992; Rowan & Andrasik, 1996; see Fig. 3).

Of course, a minimal therapist-contact approach may be poorly suited for some patients, including those who are excessively using analgesic medications, those who are clinically

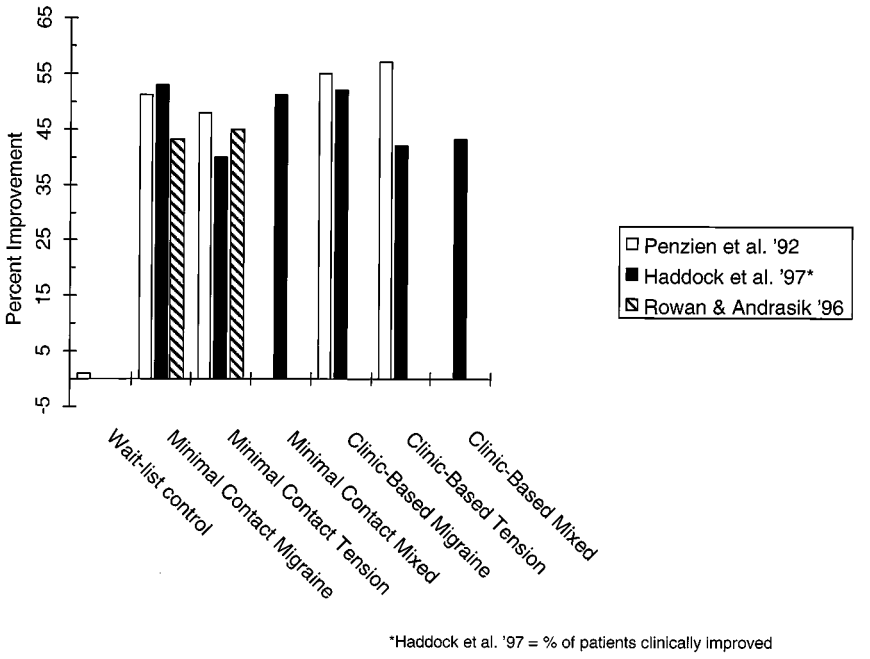

Fig. 3. Combined meta-analyses of minimal contact behavioral treatments for migraine and tension-type headache: Percent improvement scores by diagnosis and treatment condition.

depressed, or those with particularly refractory headache problems; such patients doubtless will require more therapist-intensive treatment to achieve optimal treatment results. Other patients simply do not persist in efforts to learn or apply behavioral self-management skills without regular contact from a health care professional.

Group Treatment

In clinical practice, behavioral interventions for headache are often administered in small groups (rather than individually). Although the literature addressing this treatment format is relatively scant (Napier, Miller, & Andrasik, 1997), one meta-analysis has identified 10 studies where behavioral treatments were administered in a group format (Penzien, Rains, & Holroyd, 1992). The 53% improvement associated with the group format was similar to that reported when the same interventions were individually administered. Where patient flow is adequate, group rather than individual administration of treatment allows the cost of treatment to be reduced and professional time to be efficiently allocated.

Self-Help Treatment

Of course, behavioral treatments could be made even more widely available if patients were able to learn headache self-management skills at home without any face-to-face professional assistance. Effective self-help treatment programs would also facilitate the incorporation of behavioral interventions into public health efforts to manage headaches. Few

studies have evaluated strictly "self-help" programs (i.e., no professional assistance), and those reported to date have suffered from exceptionally high attrition rates. For example, Kohlenberg and Cahn (1981) reported a substantial 62% headache reduction with their self-help program versus only 14% with information control, but their dropout rate exceeded 60%. Principal shortcomings for self-help interventions are the lack of corrective feedback, the absence of motivational assistance that is often needed during the several weeks required to develop and integrate behavioral headache self-management skills into daily routines, and less than optimal medical screening and monitoring. Self-help treatments nevertheless may prove beneficial for highly motivated patients with uncomplicated headache problems who have been cleared medically.

Internet and Mass Communications Treatments

Noteworthy efforts are underway to develop headache treatments that take advantage of the Internet and other media that may help overcome the limitations of strictly self-help approaches (e.g., deBruin-Kofman, vandeWiel, & Groenman, 1997; Strom, Peterson, & Andersson, 2000). Should a sufficiently large number of people access such programs and attain even a modest level of benefit, this approach could have a substantial impact on headache from a public health perspective. Folen, James, Earles, and Andrasik (2001) have demonstrated that it is possible to use the Internet to transport biofeedback treatment to remote sites that lack the needed expertise. Particular challenges in these types of approaches will be ensuring adequate medical evaluation and follow-up, dealing with emergencies and crises, and resolving issues related to practicing across state licensing boundaries.

Other developments in computer and information technologies offer opportunities to bring behavioral principles to bear on problems in the management of recurrent headache disorders. Computer and information systems could be readily adapted to support headache management programs (e.g., flag patients who are depressed, who may have problematic medication use patterns, or who have made emergency room visits for headache problems), and they could also be programmed to encourage clinicians to use empirically-based treatments by displaying relevant clinical guidelines when a patient's record is displayed or updated. Automated communication technologies also make it possible to cost-effectively monitor clinical outcomes that, in turn, can allow headache management problems to be identified and corrected.

HEADACHE DIAGNOSIS AND CLASSIFICATION

The diagnosis and classification of headache has undergone significant revisions over the past decade. For a quarter century, headaches were classified according to the diagnostic criteria of the Ad Hoc Committee on the Classification of Headache (1962), which was convened by the then United States National Institute of Neurological Disease and Blindness of the National Institute of Health. The Ad Hoc criteria provided brief descriptions of 15 primary headache disorders that occupied only two journal pages of the *Journal of the American Medical Association*. The headache descriptions were limited by subjective terminology such as *commonly*, *often*, *frequently*, etc, and failed to specify reproducible and essential features for diagnoses.

In an attempt to improve the sensitivity and specificity of headache diagnosis, the Headache Classification Committee of the International Headache Society (IHS; 1988)

proposed a radically new headache classification system. The IHS system introduced extensive operational criteria for diagnosis, drawing from the available literature and expert opinion and modeling the format of the *Diagnostic and Statistical Manual of Mental Disorders of the American Psychiatric Association* (*DSM-III*; American Psychiatric Association [APA], 1983). The IHS classification defined 12 major headache categories and 145 subcategories. This lengthy monograph occupies a full 96-page supplemental issue of the journal *Cephalalgia*.

Application of the IHS classification criteria for headache has improved the accuracy of headache diagnoses (Bruehl, Lofland, Semenchuk, Rokicki, & Penzien, 1999; Granella et al., 1994; Manzoni, 1995; Merikangas, Whitaker, & Angst, 1993; Michel et al., 1993; Penzien, Rains, Andrew, et al., 1992; Rasmussen, Jensen, & Olesen, 1991). The IHS criteria have become the international standard for diagnosis in headache research and have enhanced the consistency of diagnoses across studies. This is an important advance for behavioral researchers and fits with one of the evaluative criteria advanced by panels studying treatment efficacy (that "characteristics of client samples must be clearly specified"). The IHS criteria also have been generally well accepted by professionals in specialty headache clinic settings. However, few headache patients participate in research and only a fraction of headache sufferers are seen by a headache specialist and so the majority of individuals with problematic headache do not receive an IHS diagnosis.

Significant changes occurred with respect to tension-type headache. These were occasioned by increased recognition of the importance to consider frequency of occurrence (with more chronic forms being recognized as being more difficult to treat) and the uncertain role of muscle tension as a key etiological factor. The revised system asks diagnosticians to code the tension-type headache as being either episodic or chronic and to indicate whether abnormal muscle tension is present (there is evidence of pericranial muscle tenderness upon palpation or of elevated electromyographic readings) or absent. This more expanded coding format asks assessors to identify the most likely causative factors as well (psychosocial stress, anxiety, depression, delusion, etc.). Unfortunately, researchers have rarely used this level of precision when investigating tension-type headache, hence the progress has been slow at partialing out the role of numerous suspected causes and at determining whether the expanded 4-subtypes respond in a similar manner to different treatments.

Although most headache sufferers are evaluated and treated in the primary care setting, the greater diagnostic precision offered through the IHS criteria has had relatively little impact on headache diagnosis in primary care to date. Research carried out in the primary care setting found that an incorrect IHS diagnosis was often made. Vincent and deCarvalho (1999) found that only 44.9% of migraineurs, 6.7% of tension-type headache sufferers, and 26.7% of cluster headache patients received an accurate IHS diagnosis. When two coexisting headache disorders were present in a single patient, such as coexisting migraine and tension-type headache, the primary care physicians usually recorded only one diagnosis (Stang & von V. Korff, 1994). Instead, headache diagnosis was often influenced by patient characteristics (e.g., age, gender, depression) unrelated to headache symptoms or history (Stang & von V. Korff, 1994).

Because the IHS criteria improved diagnostic accuracy, it might stand to reason that fewer of the expensive diagnostic neuroimaging procedures would be needed to establish a diagnosis. On the contrary, research has demonstrated no change in the pattern or frequency of requests for brain CT or MRI scans for headache after introduction of the

IHS criteria (Fabbrini, Barbanti, Pascali, Lenzi, & Cerbo, 1999). Advancement in diagnostic systems may be ineffective unless educational programs are developed to place these tools in the hands of the appropriate healthcare providers. The American Academy of Neurology and the American Headache Society have recently developed such programs to educate primary care physicians on headache diagnosis and treatment (cf. http://www.ahsnet.org).

The release of the IHS diagnostic criteria for headache was a catalyst for renewed interest in and research on headache nosology. This research has identified strengths and limitations within the present IHS system. Certainly, the reliability of headache diagnoses was improved (Granella et al., 1994), and initial validation of the tension-type and migraine headache diagnoses has been supported (Bruehl et al., 1999; Merikangas et al., 1993; Penzien, Rains, Andrew, et al., 1992; Rasmussen et al., 1991). However, significant concerns with the criteria have emerged. The greatest controversies relate to the diagnosis of daily or high frequency migraine headache, and those cases where daily headache emerges in the context of medication overuse. It has been shown that patients who report daily or near daily, high intensity headaches do not respond well to behavioral interventions alone (Blanchard, Appelbaum, Radnitz, Jaccard, & Dentinger, 1989). Four proposals have been published to account for chronic daily migrainous headache. Solomon, Lipton, and Newman (1992) proposed the diagnostic category of "chronic daily headache evolved from migraine," which could be further subclassified as without and with medication overuse. Silberstein, Lipton, Solomon, and Mathew (1994) also proposed criteria for "transformed migraine." Manzoni et al. (1995) recommended the term "evolution of migraine." Each of these various proposed revisions to the IHS criteria invoked the concept of evolution or transformation from episodic migraine to chronic migraine. Conversely, Rains and colleagues (Rains, Penzien, Lipchik, & Ramadan, 2001) proposed a competing revision that included a diagnosis of "chronic migraine" for high frequency headache that parallels the chronic tension-type headache criteria. Medication overuse, when relevant, continues to be coded as an additional diagnosis. Although less attention has been devoted to other headache diagnoses, some revisions have been suggested for cluster headache (Torelli, Cologno, Cademartiri, & Manzoni, 2001), cervicogenic headache (Antonaci, Ghirmai, Bono, Sandrini, & Nappi, 2001), and pediatric headache (Cano et al., 2000; Gherpelli et al., 1998; Maytal, Young, Shechter, & Lipton, 1997; Winner, Martinez, Mate, & Bello, 1995). A formal revision of the IHS criteria is expected to be published in 2003 (Olesen, 2001).

The IHS criteria offer a set of additional diagnostic codes for headaches that are related to medication overuse (i.e., headache induced by chronic substance use or exposure); this is usually the second or third of multiple headache diagnoses. This provision stems from clinical research demonstrating that frequent use of analgesic or abortive medications (which are often the first line headache therapies) may have the paradoxical effect of exacerbating headache. Characteristically, the headache emerges from episodic migraine or tension-type headache into an unremitting daily headache. This process has been variously termed "analgesic rebound headache," "evolved headache," "transformed migraine," "chronic daily headache," and "drug-induced headache" (Mathew, 1997; Silberstein & Lipton, 2001). The IHS selected conservative criteria to define substance overuse, including either a typical daily dose of aspirin/acetaminophen for the past 3 months of 4 or more tablets, or a typical daily dose of prescription analgesics or sedatives for the past 3 months of 2 or more tablets. Application of the IHS substance use diagnoses requires the potentially

offending medication to be withdrawn with subsequent headache improvement in order to confirm the diagnosis.

Of particular interest are the findings that this form of headache is very difficult to treat and treatment effects are lessened when patients are allowed to continue taking excessive amounts of medication (Blanchard, Taylor, & Dentinger, 1992; Kudrow, 1982; Mathew, Kurman, & Perez, 1990; Michultka, Blanchard, Appelbaum, Jaccard, & Dentinger, 1989). Grazzi et al. (in press) hospitalized a group of refractory drug-induced headache patients so as to withdraw them from their offending medications and to start them on an appropriate prophylactic course. Some of the patients received behavioral treatment in addition to detoxification. At the first planned follow-ups (1, 3, 6, and 12 months posttreatment), both groups revealed similar levels of improvement. However, at the 3-year follow-up, patients receiving the combined treatment showed greater improvement on 2 of 3 prospectively collected measures of outcome and revealed lower rates of relapse. It is assumed that the combined treatment afforded patients a greater array of coping skills.

SELECT OTHER DIRECTIONS FOR BEHAVIORAL MANAGEMENT OF HEADACHE

Impact of the "Triptans"

With the availability and efficacy of 5HT1 agonists or "triptans," abortive medications have begun to play an increasingly important role in migraine management (Gray et al., 1999; McCrory et al., 2000; Silberstein, 2000; Silberstein, Saper, & Freitag, 2001). At the same time, the high cost of the triptans and concerns regarding complications from overuse of these medications means that methods for helping patients use these medications in an optimal fashion are needed (Silberstein & Lipton, 2001). Thus, there is a need for psychosocial interventions that enhance the effectiveness of the new abortive medications and minimize the number of doses that are required to control migraines.

Behavioral interventions generally are structured to teach a variety of headache management skills in addition to the self-regulation of specific physiological responses through biofeedback or relaxation training. Strategies for selecting the appropriate medication (e.g., analgesic, abortive or other medications) and dosing schedule for headaches of different severity, and ways to use this information to develop and individualize medication treatment plans have already been incorporated into some behavioral migraine management programs with documented benefits in terms of improved compliance and enhanced outcomes (Holroyd et al., 1988, 1989). Strategies for identifying and managing headache triggers and for identifying early headache warning signs are also a common component of behavioral self-management programs. These latter skills can not only help patients identify the optimal times for using behavioral headache management strategies, but also help patients effectively time their use of medications (abortive and analgesic). Behavioral interventions can thus be tailored to provide patients with behavioral strategies for nonpharmacological management of migraines as well as to teach skills for the effective use of analgesic and abortive drug therapies. The impact of such behavioral migraine management programs on medication use and headache treatment outcomes thus deserves additional research attention. Similar attention is warranted for biobehavioral treatment of tension-type headache.

Costs and Cost Effectiveness

In an increasingly cost-conscious healthcare environment, cost effectiveness may be as or even more important than overall treatment effectiveness in determining the implementation of any given intervention for headache (M. M. Sheffield, 1994). Clearly, cost can be an obstacle to care when treatments are expensive, and even inexpensive or moderately priced services may not be available to patients when they fall outside the scope of coverage of the third party payer system. Some attempts have been made to evaluate the cost of behavioral interventions for headache as well as their relative cost when compared to drug therapies (Haddock et al., 1996; Penzien & Rains, 2000; Rapoport & Adelman, 1998; Rowan & Andrasik, 1996); all have concluded that the standard clinic-based behavioral interventions are costly. In a retrospective analysis, Blanchard, Jaccard, Andrasik, Guarnieri, and Jurish (1985) found that medical costs during the 2-year period following behavioral treatment for headaches were markedly lower than the costs for the 2-year period prior to treatment.

Penzien and Rains (2000) provided various clinical scenarios (e.g., clinic-based vs. minimal-contact behavioral treatment, inexpensive vs. expensive preventive medications) to assess costs of treatment as they accrue over a 5-year period. In the short run, preventive drug therapy with inexpensive medications (<.75¢/day) was the least costly regimen. Even at Year 5 after therapy initiation, clinic-based behavioral therapy was more costly than medication prophylaxis with inexpensive medications. However, the break-even point for clinic-based behavioral therapy and drug prophylaxis with more expensive medications (>$1.50/day) occurred between Year 1 and Year 2. Alternatively, for all but the lowest cost medications, minimal-contact behavioral therapy was the least costly intervention within Year 1 and thereafter. At Year 1, clinic-based behavioral therapy and drug prophylaxis using expensive medications proved nearly two-thirds more costly than minimal-contact therapy. Interestingly, also at Year 1, the cumulative cost of minimal-contact therapy plus inexpensive medication prophylaxis was lower than the cumulative cost of medication prophylaxis alone using expensive medications. In the final analysis, preventive drug therapy using inexpensive medications and minimal-contact behavioral therapy are substantially more cost-conservative than headache prophylaxis using expensive medications (especially in the long run) or than standard clinic-based behavioral therapy (where professional fees are considerably higher).

These analyses demonstrate that the financial costs of headache therapy can vary considerably. While cost is only one factor to be considered in treatment planning, it can be the definitive factor. Ample empirical evidence demonstrates that behavioral interventions for migraine and tension-type headache substantially reduce the incidence of recurrent headache without risk of side effects and without the need for continuing intervention over time. Establishment of efficacy alone is insufficient to health care policy and practice. While behavioral interventions for headache have garnered increasing acceptance in recent years, their more thorough integration into mainstream health practice depends greatly upon our more systematically addressing access and cost barriers associated with this approach to care.

Integration of Behavioral Therapies into Primary Care Settings

Today, therapist-administered behavioral treatments for headache are most often provided by mental health professionals (usually clinical psychologists) within specialty

headache programs, medical school or university-based health care facilities, or private practice settings. In addition, the great majority of headache patients who are referred for or seek out behavioral therapies are those with longstanding and complicated headache problems that have proven refractory to a variety of pharmacological and often other interventions. If behavioral interventions were administered within primary care settings, they could reach and likely be of benefit to a substantially larger proportion of the headache sufferers. Administration of behavioral treatment within primary care can help to counter stigmas that are sometimes associated with services provided within psychiatric and psychological facilities, and it may increase the probability of patients following through with referral recommendations (McGrady et al., 1999). To accomplish this, a variety of hurdles must be overcome including (a) assisting busy primary care physicians to develop an efficient means of incorporating such interventions into their often hectic workload, (b) identifying who the principal provider of behavioral services would be (the physician? a physician's assistant? a nurse? a consulting psychologist?), and (c) tailoring behavioral interventions specifically for use within primary care settings. As presently applied, even minimal therapist-contact behavioral interventions for headache consume more therapist time (often 3 hours or more) than is likely to be made available in the typical primary care practitioner's office. To date behavioral interventions have been designed for patients with complicated and difficult headache problems. Patients with less difficult headache problems, however, may well benefit from greatly simplified behavioral interventions requiring much less therapist time and assistance. Development of appropriate written and audio/video materials (for review by patients in the office setting and at home) designed specifically for use in primary care settings can go a long distance toward reducing the commitment of staff time as well as the cost of the intervention. These same interventions also could readily be tailored to facilitate compliance with and effective use of the pharmacologic therapies prescribed by the primary care physician—thus the patient would receive an integrated pharmacologic-nonpharmacologic treatment package. Creative integration of behavioral therapies into primary care settings could be of substantial benefit to headache sufferers who likely otherwise would not have access to this form of care.

CLOSING COMMENTS

Migraine and tension-type headache impose substantial burdens on the headache sufferer as well as the public health system and global economy because of the high prevalence of headache sufferers and the resultant associated recurrent disability. The past 3 decades have brought substantial advances in diagnosis and management of headache disorders. Various behavioral therapies for recurrent headache have proven highly effective both in the laboratory and in clinical practice, and they have become standard components of treatment protocols for recurrent headache in specialty headache centers and other similar settings. However, there are obstacles to care and many headache sufferers do not have access to these treatments. Some promising efforts have been made to modify the format and delivery of these behavioral treatments. Mass communications technology may yield opportunities to impact a large number of individuals in a cost-effective manner. Future directions should increase the integration of behavioral treatments into the primary care settings where the majority of headache patients are treated. Clearly, better integration of behavioral therapies

for recurrent headache with other, more widely available headache treatments would allow more patients to benefit from these effective behavioral treatments.

REFERENCES

Ad Hoc Committee on Classification of Headache. (1962). Classification of headache. *Journal of the American Medical Association, 179,* 717–718.

American Psychiatric Association. (1983). *Diagnostic and statistical manual of mental disorders* (3rd ed.). Washington, DC: Author.

Andrasik, F. (1996). Behavioral management of migraine. *Biomedical and Pharmacotherapy, 50,* 52–57.

Andrasik, F. (2001). Assessment of patients with headaches. In D. C. Turk & R. Melzack (Eds.), *Handbook of pain assessment* (3rd ed., pp. 454–474). New York: Guilford Press.

Andrasik, F., Blanchard, E. B., Neff, D. F., & Rodichok, L. D. (1984). Biofeedback and relaxation training for chronic headache: A controlled comparison of booster treatments and regular contacts for long-term maintenance. *Journal of Consulting and Clinical Psychology, 52,* 609–615.

Andrasik, F., & Flor, H. (in press). Biofeedback. In H. Breivik & C. Eccleston (Eds.), *Clinical pain management: Treatment*. London: Arnold.

Andrasik, F., & Walch, S. E. (in press). Biobehavioral assessment and treatment of recurrent headaches. In A. M. Nezu, C. M. Nezu, & P. A. Geller (Eds.), *Comprehensive handbook of psychology: Vol. 9. Health psychology*. New York: Wiley.

Antonaci, F., Ghirmai, S., Bono, G., Sandrini, G., & Nappi, G. (2001). Cervicogenic headache: Evaluation of the original diagnostic criteria. *Cephalalgia, 21,* 573–583.

Blanchard, E. B. (1992). Psychological treatment of benign headache disorders. *Journal of Consulting and Clinical Psychology, 60,* 537–551.

Blanchard, E. B., & Andrasik, F. (1982). Psychological assessment and treatment of headache: Recent developments and emerging issues. *Journal of Consulting and Clinical Psychology, 56,* 859–879.

Blanchard, E. B., & Andrasik, F. (1987). Biofeedback treatment of vascular headache. In J. P. Hatch, J. G. Fisher, & J. D. Rugh (Eds.), *Biofeedback: Studies in clinical efficacy* (pp. 1–79). New York: Plenum.

Blanchard, E. B., Andrasik, F., Ahles, T. A., Teders, S. J., & O'Keefe, D. (1980). Migraine and tension-type headache: A meta-analytic review. *Behavior Therapy, 11,* 613–631.

Blanchard, E. B., Andrasik, F., Jurish, S. E., & Teders, S. J. (1982). The treatment of cluster headache with relaxation and thermal biofeedback. *Biofeedback and Self-Regulation, 7,* 185–191.

Blanchard, E. B., Appelbaum, K. A., Guarnieri, P., Morrill, B., & Dentinger, M. P. (1987). Five year prospective follow-up on the treatment of chronic headache with biofeedback and/or relaxation. *Headache, 27,* 580–583.

Blanchard, E. B., Appelbaum, K. A., Radnitz, C. L., Jaccard, J., & Dentinger, M. P. (1989). The refractory headache patient. I. Chronic daily, high intensity headache. *Behaviour Research and Therapy, 27,* 403–410.

Blanchard, E. B., Jaccard, J., Andrasik, F., Guarnieri, P., & Jurish, S. E. (1985). Reduction in headache patients' medical expenses associated with biofeedback and relaxation treatments. *Biofeedback and Self-Regulation, 10,* 63–68.

Blanchard, E. B., Taylor, A. E., & Dentinger, M. P. (1992). Preliminary results from the self-regulatory treatment of high medication consumption headache. *Biofeedback and Self-Regulation, 17,* 179–202.

Bogaards, M. C., & terKuile, M. M. (1994). Treatment of recurrent tension headache: A meta-analytic review. *Clinical Journal of Pain, 10,* 174–190.

Bruehl, S., Lofland, K. R., Semenchuk, E. M., Rokicki, L. A., & Penzien, D.B. (1999). Use of the cluster analysis to validate IHS diagnostic criteria for migraine and tension-type headache. *Headache, 39,* 181–189.

Bruhn, P., Olesen, J., & Melgaard, B. (1979). Controlled trial of EMG feedback in muscle contraction headache. *Annals of Neurology, 6,* 34–36.

Budzynski, T., Stoyva, J., & Adler, C. (1970). Feedback induced muscle relaxation: Application to tension headache. *Journal of Behavior Therapy and Experimental Psychiatry, 1,* 205–211.

Campbell, J. K., Penzien, D. B., & Wall, E. M. (2000). *Evidence-based guidelines for migraine headaches: Behavioral and physical treatments.* Retrieved from http://www.aan.com/public/practiceguidelines/headache_gl.htm

Cano, A., Palomeras, E., Alfonso, S., Ortega, D., Sanz, P., & Fossas, P. (2000). Migraine without aura and migrainous disorder in children: International Headache Society (IHS) and revised IHS criteria. *Cephalalgia, 20,* 617–620.

Clouse, J. C., & Osterhaus, J. T. (1994). Healthcare resources use and costs associated with migraine in a managed healthcare setting. *Annals of Pharmacotherapy, 28,* 659–664.

Davis, M. K., Holroyd, K. A., & Penzien, D. B. (1999). Flunarizine and propranolol: Comparative effectiveness in the treatment of migraine headaches. *Headache, 39,* 349.

deBruin-Kofman, A.T., vandeWiel, H., & Groenman, N. H. (1997). Effects of a mass media behavioral treatment for chronic headache: A pilot study. *Headache, 37,* 415–420.

Diamond, S., & Freitag, F. G. (1989). Treatment of headaches. *Clinical Journal of Pain, 5*(2), S7–S16.

Diamond, S., & Montrose, D. (1984). The value of biofeedback in the treatment of chronic headache: A four-year retrospective study. *Headache, 24,* 5–18.

Duckro, P. N., Tait, R., Margolis, R. B., & Silvermintz, S. (1985). Behavioral treatment of headache following occupational trauma. *Headache, 25,* 328–331.

Fabbrini, G., Barbanti, P., Pascali, M. P., Lenzi, G. L., & Cerbo, R. (1999). Impact of the International Headache Society criteria on the use of neuroimaging for headache diagnosis in a headache clinic. *Headache, 39,* 747–751.

Folen, R. A., James, L. C., Earles, J. E., & Andrasik, F. (2001). Biofeedback via telehealth: A new frontier for applied psychophysiology. *Applied Psychophysiology and Biofeedback, 26,* 195–204.

Gherpelli, J. L., Nagae Poetscher, L. M., Souza, A. M., Bosse, E. M., Rabello, G. D., Diament, A., et al. (1998). Migraine in childhood and adolescence: A critical study of the diagnostic criteria and the influence of age on clinical findings. *Cephalalgia, 18,* 333–341.

Glass, G. V. (1976). Primary, secondary, and meta-analysis of research. *Educational Researcher, 10,* 3–8.

Goslin, R. E., Gray, R. N., McCrory, D. C., Penzien, D. B., Rains, J. C., & Hasselblad, V. (1999, February). *Behavioral and physical treatments for migraine headache* (Technical Review 2.2). Prepared for the Agency for Health Care Policy and Research under Contract No. 290-94-2025. (NTIS Accession No. 127946)

Granella, F., Alessndro, R. D., Manzoni, G. C., Cerbo, R., D'Amato, C. C., Pini, L. A., et al. (1994). International Headache Society classification: Interobserver reliability in the diagnosis of primary headaches. *Cephalalgia, 14,* 16–20.

Gray R. N., Goslin, R. E., McCrory, D. C., Eberlein, K., Tulsky, J., & Hasselblad, V. (1999, February). *Drug treatments for the prevention of migraine headache* (Technical Review 2.3). Prepared for the Agency for Health Care Policy and Research under contract no. 29009402025. (NTIS Accession No. 127953)

Gray, R. N., McCrory, D. C., Eberlein, K., Westman, E. C., & Hasselblad, V. (1999, February). *Self-administered drug treatments for acute migraine headache* (Technical Review 2.4). Prepared for the Agency for Health Care Policy and Research under contract no. 29009402025. (NTIS Accession No. 127854)

Grazzi, L., Andrasik, F., D'Amico, D., Leone, M., Usai, S., Kass, S. J., et al. (in press). Behavioral and pharmacological treatment of drug-induced daily headache: Outcome at three years. *Headache.*

Haddock, C. K., Rowan, A. B., Andrasik, F., Wilson. P. G., Talcott, G. W., & Stein, R. J. (1996). Home-based behavioral treatments for chronic benign headache: A meta-analysis of controlled trials. *Cephalalgia, 17,* 113–118.

Hay, K. M., & Madders, J. (1971). Migraine treated by relaxation therapy. *Journal of the Royal College of General Practitioners, 21,* 644–649.

Headache Classification Committee of the International Headache Society. (1988). Classification and diagnostic criteria for the headache disorders, cranial neuralgias, and facial pain. *Cephalalgia, 8*(Suppl. 7), 1–96.

Holroyd, K. A., Cordingley, G. E., Pingel, J. D., Jerome, A., Theofanous, A. G., Jackson, D. K., et al. (1989). Enhancing the effectiveness of abortive therapy: A controlled evaluation of self-management training. *Headache, 29,* 148–153.

Holroyd, K. A., Holm, J. E., Hursey, K. G., Penzien, D. B., Cordingley, G. E., Theofanous, A. G., et al. (1988). Recurrent vascular headache: Home-based behavioral treatment vs. abortive pharmacological treatment. *Journal of Consulting and Clinical Psychology, 56,* 218–223.

Holroyd, K. A., Nash, J. M., Pingel, J. D., Cordingley, G. E., & Jerome, A. (1991). A comparison of pharmacological (amitriptyline HCL) and nonpharmacological (cognitive–behavioral) therapies for chronic tension headaches. *Journal of Consulting and Clinical Psychology, 59*(3), 387–393.

Holroyd, K. A., O'Donnell, F. J., Stensland, M., Lipchik, G. L., Cordingley, G. E., & Carlson, B. W. (2001). Management of chronic tension-type headache with tricyclic antidepressant medication, stress management therapy, and their combination: A randomized controlled trial. *Journal of American Medical Association, 285,* 2208–2215.

Holroyd, K. A., & Penzien, D. B. (1986). Client variables and the behavioral treatment of recurrent tension headache: A meta-analytic review. *Journal of Behavioral Medicine, 9,* 515–536.

Holroyd, K. A., & Penzien, D. B. (1990). Pharmacological vs. nonpharmacological prophylaxis of recurrent migraine headache: A meta-analytic review of clinical trials. *Pain, 42,* 1–13.

Holroyd, K. A., Penzien, D. B., & Cordingley, G. A. (1991). Propranolol in the prevention of recurrent migraine: A meta-analytic review. *Headache, 31,* 333–340.

Holroyd, K. A., Penzien, D. B., & Lipchik, G. L. (2001). Behavioral management of headache. In S. D. Silberstein, R. B. Lipton, & D. J. Dalessio (Eds.), *Wolff's headache and other head pain* (7th ed., pp. 562–598). New York: Oxford University Press.

Holroyd, K. A., Penzien, D. B., Rokicki, L. A., & Cordingley, G. E. (1992). Flunarizine vs. propranolol: A meta-analysis of clinical trials. *Headache, 32,* 256.

Hu, X. H., Markson, L. E., Lipton, R. B., Stewart, W. F., & Berger, M. L. (1999). Burden of migraine in the United States: Disability and economic costs. *Archives of Internal Medicine, 159,* 813–818.

Jensen, R. (1999). Pathophysiological mechanisms of tension-type headache: A review of epidemiologic and experimental studies. *Cephalalgia, 19,* 602–621.

Kohlenberg, R. J., & Cahn, T. (1981). Self-help treatment for migraine headaches: A controlled outcome study. *Headache, 21,* 196–200.

Kudrow, L. (1982). Paradoxical effects of frequent analgesic use. In M. Critchley, A. Friedman, S. Gorini, & F. Sicuteri (Eds.), *Headache: Physiopathological and clinical concepts. Advances in neurology* (Vol. 33, pp. 335–341). New York: Raven.

Lake, A., Saper, J., Madden, S., & Kreeger, C. (1993). Comprehensive inpatient treatment for intractable migraine: A prospective longterm outcome study. *Headache, 33,* 55–62.

Lipton, R. B., Diamond, S., Reed, M. L., Diamond, M. L., & Stewart, W. F. (2001). Migraine diagnosis and treatment: Results from the American Migraine Study II. *Headache, 41,* 638–645.

Manzoni, G. C. (1995). Classification of primary headache and International Headache Society diagnostic criteria 1988: Critical review. *Italian Journal of Neurological Science, 16*(Suppl. 8), 9–14.

Manzoni, G. C., Granella, F., Sandrini, G., Cavallini, A., Zanferrari, C., & Napi, G. (1995). Classification of chronic daily headache by International Headache Society criteria: Limits and new proposals. *Cephalalgia, 15,* 37–43.

Mathew, N. T. (1981). Prophylaxis of migraine and mixed headache: A randomized controlled study. *Headache, 21,* 105–109.

Mathew, N. T. (1997). Transformed migraine, analgesic rebound and other chronic daily headaches. *Neurologic Clinics, 15,* 167–186.

Mathew, N. T., Kurman, R., & Perez, F. (1990). Drug induced refractory headache—Clinical features and management. *Headache, 30,* 634–638.

Maytal, J., Young, M., Shechter, A., & Lipton, R. B. (1997). Pediatric migraine and the International Headache Society (IHS) criteria. *Neurology, 48,* 602–607.

McCrory, D. C., Matchar, D. B., Gray, R. N., Rosenberg, J. H., & Silberstein, S. D. (2000). *Evidence-based guidelines for migraine headache: Overview of program description and methodology.* Retrieved from http://www.aan.com/public/practiceguidelines/headache_gl.htm

McCrory, D. C., Penzien, D. B., Hasselblad, V., & Gray, R. N. (2001). *Evidence report: Behavioral and physical treatments for tension-type and cervicogenic headache* (Product No. 2085). Des Moines, IA: Foundation for Chiropractic Education and Research.

McGrady, A. V., Andrasik, F., Davies, T., Striefel, S., Wickramasekera, I., Baskin, S. M., et al. (1999). Psychophysiologic therapy for chronic headache in primary care. *Primary Care Companion Journal of Clinical Psychiatry, 1,* 96–102.

Merikangas, K. R., Whitaker, A. E., & Angst, J. (1993). Validation of diagnostic criteria for migraine in the Zurich longitudinal cohort study. *Cephalalgia, 13*(Suppl. 12), 47–53.

Michel, P., Dartingues, J. F., Tison, S., Auriacombe, S., Brochet, B., Vivares, C., et al. (1993). Validity of the International Headache Society criteria for migraine. *Neuroepidemiology, 12,* 51–57.

Michultka, D. M., Blanchard, E. B., Appelbaum, K. A., Jaccard, J., & Dentinger, M. P. (1989). The refractory headache patient. II. High medication consumption (analgesic rebound) headache. *Behaviour Research and Therapy, 27,* 411–420.

Mitchell, K. R. (1969). The treatment of migraine: An exploratory application of time limited behaviour therapy. *Technology, 14,* 50–55.

Napier, D. A., Miller, C. M., & Andrasik, F. (1997). Group treatment for recurrent headache. *Advances in Medical Psychotherapy, 9,* 21–31.

Olesen, J. (2001). Revision of the international headache classification: An interim report. *Cephalalgia, 21,* 261.

Penzien, D. B., Holroyd, K. A., Holm, J. E., & Hursey, K. G. (1985). Behavioral management of migraine: Results from five-dozen group outcome studies. *Headache, 25,* 162.

Penzien, D. B., Johnson, C. A., Carpenter, D. E., & Holroyd, K. A. (1990). Drug vs. behavioral treatment of migraine: Long-acting propranolol vs. home-based self-management training. *Headache, 30,* 300.

Penzien, D. B., & Rains, J.C. (2000). Cumulative expense of preventive treatment for migraine. *Headache, 40,* 423.

Penzien, D. B., Rains, J. C., Andrew, M. E., Knowlton, G. E., McAnulty, R. D., & Hursey, K. G. (1992). Computer-aided system for headache diagnosis with the IHS headache diagnostic criteria—II: Refinement and validation. *Headache, 32,* 257.

Penzien, D. B., Rains, J. C., & Holroyd, K. A. (1992). A review of alternative behavioral treatments for headache. *The Mississippi Psychologist, 17,* 8–9.

Penzien, D. B., Rains, J. C., & Holroyd, K. A. (1993). Psychological assessment of the recurrent headache sufferer. In C. D. Tollison & R. S. Kunkel (Eds.), *Headache: Diagnosis and treatment* (pp. 39–49). Baltimore: Williams and Wilkins.

Rains, J. C., Penzien, D. B., Lipchik, G. L., & Ramadan, N. M. (2001). Diagnosis of migraine: Empirical analysis of a large clinical sample of atypical migraine (IHS 1.7) patients and proposed revision of the IHS criteria. *Cephalalgia*, *21*, 584–595.

Rains, J. C., Penzien, D. B., & Martin, V. (2002). Migraine and women's health. *Journal of the American Medical Women's Association*, *57*, 73–78.

Ramadan, N. M., & Keidel, M. (2000). Chronic posttraumatic headache. In J. Olesen, P. Tfelt-Hansen, & K. M. A. Welch (Eds.), *The headaches* (2nd ed., pp. 771–780). Philadelphia: Lippincott Williams & Wilkins.

Rapoport, A. M., & Adelman, J. U. (1998). Cost of migraine management: A pharmacoeconomic overview. *American Journal of Managed Care*, *4*(4), 531–545.

Rasmussen, B. K., Jensen, R., & Olesen, J. (1991). A population-based analysis of the diagnostic criteria of the International Headache Society. *Cephalalgia*, *11*, 129–134.

Reich, B. A., & Gottesman, B. (1993). Biofeedback and psychotherapy in the treatment of muscle contraction/tension-type headache. In C. D. Tollison & R. S. Kunkel (Eds.), *Headache: Diagnosis and treatment* (pp. 167–183). Baltimore: Williams and Wilkins.

Ries, P. W. (1986). *Current estimates from the National Health Interview Survey, United States, 1984* (Series 10, No. 156, DHHS Publication No. PHS 86-1584). Washington, D.C., National Center for Health Statistics. Vital Health statistics.

Rowan, A. B., & Andrasik, F. (1996). Efficacy and cost-effectiveness of minimal therapist contact treatments for chronic headache: A review. *Behavior Therapy*, *27*, 207–234.

Sanin, L. C., Mathew, N. T., Bellmeyer, L. R., & Ali, S. (1994). The International Headache Society (IHS) headache classification as applied to a headache clinic population. *Cephalalgia*, *14*, 443–446.

Sargent, J. D., Green, E. E., & Walters, E. D. (1972). The use of autogenic feedback training in a pilot study of migraine and tension headaches. *Headache*, *12*, 120–125.

Schwartz, B. S., Stewart, W. F., Simon, D., & Lipton, R. B. (1998). Epidemiology of tension-type headache. *Journal of the American Medical Association*, *279*, 381–383.

Sheffield, M. M. (1994). Psychosocial interventions in the management of recurrent headache disorders 3: Policy considerations for implementation. *Behavioral Medicine*, *20*, 74–77.

Sheffield, R. E. (1998). Migraine prevalence: A literature review. *Headache*, *38*, 595–601.

Silberstein, S. D. (2000). Practice parameter: Evidence-based guideline for migraine headache (an evidence-based review). *Neurology*, *55*, 754–763.

Silberstein, S. D., & Lipton, R. B. (2001). Chronic daily headache, including transformed migraine, chronic tension-type headache, and medication overuse. In S. D. Silberstein, R. B. Lipton, & D. J. Dalessio (Eds.), *Wolff's headache and other head pain* (7th ed., pp. 247–284). New York: Oxford University Press.

Silberstein, S. D., Lipton, R. B., Solomon, S., & Matthew, N. T. (1994). Classification of daily and near-daily headaches: Proposed revisions to the IHS criteria. *Headache*, *34*, 1–7.

Silberstein, S. D., & Merriam, G. R. (1991). Estrogens, progestins, and headache. *Neurology*, *41*, 786–793.

Silberstein, S. D., Saper, J. R., & Freitag, F. G. (2001). Migraine: Diagnosis and treatment. In S. D. Silberstein, R. B. Lipton, & D. J. Dalessio (Eds.), *Wolff's headache and other head pain* (7th ed., pp. 121–237). New York: Oxford University Press.

Smith, M. L., & Glass, G. V. (1977). Meta-analysis of psychotherapy outcome studies. *American Psychologist*, *32*, 753–760.

Solomon, S., Lipton, R. B., & Newman, L. C. (1992). Evaluation of chronic daily headache—comparison to criteria for chronic tension-type headache. *Cephalalgia*, *12*, 365–368.

Sovak, M., Kunzel, M., Sternbach, R. A., & Dalessio, D. J. (1981). Mechanism of the biofeedback therapy of migraine: Volitional manipulation of the psychophysiological background. *Headache*, *21*, 89–92.

Stang, P. E., & von V. Korff, M. (1994). The diagnosis of headache in primary care: Factors in the agreement of clinical and standardized diagnoses. *Headache*, *34*, 138–142.

Strom, L., Peterson, R., & Andersson, G. (2000). A controlled trial of self-help treatment of recurrent headache conducted via the Internet. *Journal of Consulting and Clinical Psychology*, *68*, 722–727.

Torelli, P., Cologno, D., Cademartiri, C., & Manzoni, G. C. (2001). Application of the International Headache Society classification criteria in 652 cluster headache patients. *Cephalalgia*, *21*, 145–150.

Uknis, A., & Silberstein, S. D. (1991). Migraine and pregnancy. *Headache*, *31*, 372–374.

Vincent, M. B., & deCarvalho, J. J. (1999). Primary headache care delivery by nonspecialist in Brazil: Brazil Headache Care Cooperative Group. *Cephalalgia*, *19*, 520–524.

Winner, P., Martinez, W., Mate, L., & Bello, L. (1995). Classification of pediatric migraine: Proposed revisions to the IHS criteria. *Headache*, *35*, 407–410.