Empirically Supported Treatments in Pediatric Psychology: Recurrent Pediatric Headache

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Objective: To review the empirical research examining behavioral treatments for recurrent pediatric headache.

Methods: Thirty-one investigations published after 1980 were reviewed using predetermined criteria to evaluate the adequacy of research methodologies. A modification of criteria proposed for evaluating the efficacy of psychological interventions for adults (Task Force on Promotion and Dissemination of Psychological Procedures, 1995) was used to evaluate the adequacy of evidence available for individual intervention strategies.

Results: Sufficient evidence exists to conclude that relaxation/self-hypnosis is a well-established and efficacious treatment for recurrent headache. Furthermore, enough evidence exists to conclude that thermal biofeedback alone is a probably efficacious treatment. Other promising interventions have been tested that combine relaxation and biofeedback or integrate other cognitive-behavioral treatment approaches, but are limited by inadequate research methodologies.

Conclusions: We discuss the importance of developmentally based conceptual models and the impact of diagnostic heterogeneity and offer specific recommendations for future intervention research in the area of recurrent pediatric headache.

Key words: headache; relaxation; biofeedback; treatment outcomes.

Recurrent pediatric headache is a pain syndrome in children and adolescents that occurs frequently, results in significant specific episodic functional disability, and can produce chronic debilitation. Prevalence estimates indicate that severe recurrent headache occurs at a rate of 25.3 per 1,000, or in approximately 2.5% of the child and adolescent population (Newacheck & Taylor, 1992). It has been estimated that nearly one million children and adolescents suffer from migraine headaches specifically and that several hundred thousand school days are missed each month due to pediatric migraine (Stang & Osterhaus, 1993). Substantially higher prevalence rates (e.g., 5%) were reported in the now classic study of children in Sweden by Bille (1962). More recently, Sillanpaa and Anttila (1996) reported a 5.7% migraine prevalence rate in Finnish school-children and suggested that overall prevalence rates may have increased substantially over the last two decades. The higher prevalence rates reported in the Scandinavian studies may be due to the use of different diagnostic criteria. Beyond the issue of high overall prevalence rates, however, it is important to...
note that severe recurrent headaches may result in chronic functional disability, limiting participation in social activities and placing children at risk for the development of associated psychopathology.

Despite the relatively high prevalence rate and significant disability associated with recurrent pediatric headache, it has not received as much attention as other chronic physical illnesses in children and adolescents. Recurrent headaches are only rarely linked to underlying conditions that result in significant physical impairment or mortality. Several other factors have contributed to this inattention, such as the absence of objective biomedical measures of diagnosis, the reliance on subjective self-report as the basis for symptom confirmation, and the common occurrence of sporadic headache within the entire population. These latter factors emphasize the importance of psychological approaches to the study of recurrent pediatric headache. However, the lack of developmental models of symptom expression and disease progression in pediatric headache has limited the development of the psychological literature. Integration of the headache literature with the results of basic developmental pain research in children is needed to provide a more informative conceptual model.

The purpose of this article is to review the literature on the behavioral/psychological treatment of recurrent pediatric headache. First, we will briefly review general issues regarding the diagnosis, etiology, and management of recurrent pediatric headache. Specific criteria will be applied to evaluate the methodological adequacy of treatment outcome research and to determine the evidence for efficacy of individual treatment strategies. We will then offer conclusions regarding the efficacy of treatment approaches and recommendations for future treatment outcome research.

Recurrent Pediatric Headache

Diagnostic Issues

Clarity with respect to diagnosis is an important issue to consider in any discussion of recurrent headache syndromes, particularly in the pediatric population where diagnoses are often based on the direct application of adult syndromic criteria or adaptations of them that may not be generally approved in the scientific community. From a research perspective, lack of diagnostic reliability and validity results in heterogeneous samples, creating problems with measuring outcomes and limiting the generalizability of the results obtained from treatment outcome research. Historically, headaches have been classified as either migraine or tension, based on the presence of autonomic nervous system symptoms (e.g., nausea and/or vomiting, photophobia and/or phonophobia) and the quality of pain (e.g., pulsatile versus squeezing/bandlike) (Ad Hoc Committee on the Classification of Headache, 1962). Prensky (1976) proposed modifications of the Ad Hoc criteria for children that have been shown to improve diagnostic sensitivity and specificity when compared to clinicians’ diagnoses (Gladstein, Holden, Peralta, & Raven, 1993).

In 1988, however, the International Headache Society presented a new set of operationalized diagnostic criteria for headache syndromes (Headache Classification Committee of the IHS, 1988). Migraine with and without aura and episodic and chronic tension headaches were included within this system. Although these criteria represented a significant improvement over the Ad Hoc classification system (1962) by offering a wider range of well-specified headache syndromes, they were created without consideration of children and adolescents. Tests of the sensitivity and specificity of the IHS system in pediatric populations have yielded results no better than those found with previously existing criteria; recommendations have been made for modifications that will improve the utility of these diagnostic criteria in pediatric populations. Such adjustments include altering criteria for headache duration and number of autonomic nervous system symptoms required to confirm diagnoses (Gladstein et al., 1993; Maytal, Young, Shechter, & Lipton, 1997). Recent comprehensive models of headache have moved away from the migraine/tension dichotomy and emphasized a “headache continuum,” with head pain being the common feature and a higher prevalence of autonomic nervous system symptoms at one end of the continuum and muscular tension-associated symptom parameters at the other end of the continuum (Rapoport & Sheftell, 1996). These models have not been fully validated within the biomedical literature, although a model focusing on a continuum of severity of symptoms as the cardinal feature in pediatric headache has been presented in the literature (Joffe, Bakal, & Kaganov, 1983).

An alternative diagnostic category, “chronic daily headache,” has been identified within the last 10 years (Solomon, Lipton, & Newman, 1992). Multiple subdiagnostic categories are available for
chronic daily headache, with the central feature being the presence of daily headaches that vary in duration, intensity, and accompanying symptoms. A fifth diagnostic category for chronic daily headaches in children and adolescents, termed comorbid because of the parallel presentation of periodic well-defined migraine and chronic daily headache, was identified by Gladstein and Holden (1996). In addition, these authors reported higher rates of functional disability associated with chronic daily headaches than that associated with migraine in pediatric populations (Holden, Gladstein, Trulsen, & Wall, 1994). There are arguments against focusing on a categorical approach to headaches, but there is insufficient empirical support for the utility of multivariate linear models in the literature.

Etiology and Factors

Etiology of recurrent headache in both pediatric and adult populations is not completely understood. A complex set of genetic factors appears to be involved, at least with headaches that have a strong autonomic nervous system component (Scheller, 1995). Recent twin studies have reported a significant genetic basis for both migraine and tension headaches that is stronger for women than men, with unshared environmental factors moderating phenotypic expression (Honkasalo et al., 1995; Larsson et al., 1995). More general models of headache etiology propose an inherited headache predisposition triggered by a wide range of biological (e.g., menarche) or psychosocial factors (e.g., stress), with the course moderated by multiple individual difference variables. For individual headache episodes, both central and peripheral nervous system components are likely involved; most research in this area focuses on unstable serotonergic pathways and the roles of inflammatory neuropeptides in initiating and sustaining individual headache episodes (Rapoport & Sheftell, 1996). Recent advances in the understanding of the biomedical substrate of migraine has resulted in the development of potent abortive pharmacotherapies (e.g., sumatriptan) used with increasing frequency in children and adolescents (Solomon, 1995).

A comprehensive conceptual model of the psychological factors involved in recurrent headache was recently presented by Martin (1993). The basic assumption underlying Martin’s functional model is that environmental and individual subjective events occurring prior to, during, and following pain episodes have a significant influence on the course and outcomes associated with recurrent headache syndromes. Within this model, antecedents, characteristics of headache episodes, and associated individual as well as interpersonal consequences are specified as targets for clinical intervention and treatment outcome research protocols. Although this model was developed based on clinical and research experiences with adults, it appears to have utility in its application to recurrent pediatric headache. There is evidence in the adult literature to support the importance of antecedents and consequences in recurrent headache syndromes (Martin, Milech, & Nathan, 1993; Martin & Seneviratne, 1997; Martin & Theunissen, 1993) and the significance of a child’s coping style as an important moderator influencing headache outcomes in children has been reported (Holden et al., 1994; Holden, Rawlins, & Gladstein, 1998). Developmental adaptations and support for this model in the pediatric arena will provide a more well-informed conceptual foundation for treatment outcome research.

Excellent reviews of the treatment of recurrent headaches are available in the literature (Blanchard, 1992; Blanchard & Diamond, 1996), some focusing specifically on pediatric populations (Hermann, Kim, & Blanchard, 1995; McGrath & Humphreys, 1989; McGrath & Reid, 1995). These reviews provide evidence for the efficacy of psychological approaches in the treatment of headache. Furthermore, in a meta-analysis of the treatment outcome literature, Hermann and colleagues (1995) reported larger treatment effect sizes for psychological interventions than for pharmacological interventions in pediatric migraine. Fewer outcome data, however, are available that directly compare psychological interventions to pharmacological approaches. In general, pharmacotherapy has not been as thoroughly investigated in pediatric populations as it has been with adults, limiting the availability of data for making appropriate comparisons.

Psychological Interventions for Recurrent Pediatric Headache

For this review, we conducted computerized literature searches of Psychological Abstracts and Index Medicus. Additional references were obtained from the articles’ reference lists. Only those studies published since 1980 were included in the review. Thirty-one published studies were located and grouped by type of intervention tested in the
Appendix. These included intervention studies evaluating the efficacy of relaxation/self-hypnosis, biofeedback, combined relaxation/self-hypnosis and biofeedback, and interventions that did not fit into those previously defined categories including mixed interventions employing cognitive-behavioral, multicomponent, stress management or contingency management approaches. The Appendix provides detailed information on the subjects, diagnostic criteria, baseline, experimental design, assessment measures, treatment protocol, immediate outcomes, and follow-up outcomes. It should be noted that standardized headache diaries have become the accepted measurement strategy for evaluating outcome in this area and were used in each of the studies reviewed.

We used a modification of criteria proposed for evaluating the efficacy of psychological interventions for adults (Task Force on Promotion and Dissemination of Psychological Procedures, 1995) to evaluate the adequacy of evidence available for individual intervention strategies. To qualify as a well-established treatment, the intervention must have been tested in a randomized group design that displayed superiority over placebo or alternative treatment with adequate statistical power. Alternatively, a large series of appropriately controlled single-case design experiments that compare the intervention to another treatment may also suffice. In either case, effects must be demonstrated by at least two independent research groups and samples must be adequately described. Allowances made for pediatric populations are that the study must include a clear description of the intervention (in lieu of manuals) and that the number of subjects in the intervention groups may be fewer than 30. Probably efficacious treatments require (1) two or more group intervention studies displaying superiority over a waiting list control group or (2) one study meeting the criteria for a well-established intervention. Promising interventions require (1) positive support from one well-controlled study and at least one other less well controlled study, or (2) a small number of single case design experiments, or (3) two or more well-controlled studies by the same investigator.

**Relaxation Therapies**

The category of interventions including relaxation training, self-hypnosis, autogenic training, and guided imagery contains some of the more common clinical approaches used to treat recurrent headaches (Blanchard & Diamond, 1996; McGrath, 1990; NIH Technology Assessment Statement, 1995). Due to the conceptual and practical similarity of these interventions, they have been grouped into one category for the purposes of this review. These interventions typically focus on a form of progressive or imagery-guided relaxation appropriate for age level, with daily practice encouraged. As skills develop, patients are encouraged to use their specific relaxation approach as a coping strategy at the initial onset of specific headache episodes, in addition to daily practice, which may have a prophylactic effect.

Our review of the literature indicated that 11 studies tested the efficacy of relaxation/self-hypnosis/guided imagery as a treatment for recurrent headaches. Eight of these intervention trials employed a randomized control group design. In each of these studies, the treatment protocol was clearly specified and characteristics of the client samples were appropriately detailed. Sufficient demographic information and specific data on headache diagnoses were provided across all studies, with only two of the studies clearly focusing on the treatment of migraine, while the others treated heterogeneous diagnostic samples. Clearly described treatment strategies that could be replicated by other investigators were also included. Only four of the studies (Emmen & Paschier, 1988; Larsson & Melin, 1986; McGrath et al., 1988; McGrath et al., 1992) compared interventions to appropriate placebo control groups. Two of these studies (Larsson & Melin, 1986; McGrath et al., 1992) independently indicated that relaxation therapy was superior to a placebo control condition, whereas Emmen and Paschier (1988) and McGrath et al. (1988) did not find evidence for superiority of relaxation over placebo. Further support for relaxation therapy as an intervention for recurrent headache is available from the results of randomized, controlled investigations that compared this intervention to self-monitoring (Larsson, Melin, Lamminen, & Ullsted, 1987; Larsson, Dalefod, Hakansson, & Melin, 1987) or waiting list controls (Engel, Rapoff, & Pressman, 1992), as well as one study that used a multiple baseline design (Engel, 1992).

Follow up data collected at varying posttreatment intervals generally indicated maintenance of change across all investigations in this area. Furthermore, interventions were delivered in a variety
of formats including group interventions delivered through school-based programs (Emmen & Paschier, 1988; Larsson & Melin, 1986; Larsson, Daleflood, et al., 1987; Larsson, Melin, et al., 1987) and self-help interventions requiring minimal therapist contact (Larsson, Melin, et al., 1987; McGraith et al., 1992). Results suggest that school-based interventions are as effective as clinic-based interventions; additional evidence supports interventions that rely more on self-help than clinically based strategies.

Two separate crossover studies have evaluated the efficacy of relaxation/self-hypnosis and medication in the treatment of recurrent pediatric headache (Larsson, Melin, & Doberl, 1990; Olness, MacDonald, & Uden, 1987). The Larson et al. study was a randomized, double-blind crossover testing the efficacy of home-based relaxation training versus prophylactic pharmacotherapy in the treatment of adolescents with tension headaches. Significant improvement occurred as a function of home-based relaxation with no further improvement in outcome associated with additional pharmacotherapy. This is the only published study that addressed the additive effects of behavioral therapy and pharmacotherapies on the treatment of recurrent pediatric headache. Olness et al. compared self-hypnosis and propranolol as treatments for migraine with aura in a randomized, double-blind crossover trial. Self-hypnosis significantly lowered the frequency, but not the intensity, of headaches compared to propranolol; however, drug washout periods were relatively short in this study, limiting the utility of its results. There is a clear need for the treatment literature to begin to address the combined contributions of pharmacotherapy and psychological intervention to initial cessation of symptoms and long-term maintenance of positive gains in recurrent pediatric headache.

Many of the intervention studies testing the efficacy of relaxation/self-hypnosis employed interventions that involved other components such as self-monitoring and cognitive-behavioral problem solving. It is unclear whether positive intervention effects result solely from the specific effects of relaxation/self-hypnosis or from other cognitive-behavioral intervention components.

**Biofeedback**

Biofeedback has long been used in the treatment of adult headache (Blanchard, 1992; Blanchard & Diamond, 1996; NIH Technology Assessment Statement, 1995; Schwartz, 1995) and has received a reasonable amount of attention in the pediatric headache literature (Culbert, Kajander, & Reaney, 1996). Both electromyographic (EMG) and thermal biofeedback have been employed to treat recurrent pediatric headache. The EMG biofeedback for headache (Schwartz, 1995) consists of monitoring auditory and/or visual signals from electrical impulses generated primarily from the frontalis or forehead muscle. Thermal biofeedback typically involves monitoring auditory and/or visual feedback from a thermistor placed on the fingers. Theoretically and conceptually, thermal biofeedback should have utility in the treatment of migraine headaches due to the strong vascular components involved and the well-documented impact of volitional control of body temperature on vasoconstriction and vasodilation (Schwartz, 1995). An external auditory or visual signal may assist children and adolescents with lowering arousal, especially in cases where relaxation through other techniques has proven difficult.

Seven studies reported on the specific results of biofeedback in the treatment of recurrent pediatric headache while another ten investigations either used biofeedback as part of a multicomponent treatment strategy or compared biofeedback with other interventions such as self-hypnosis/relaxation. Six of the seven investigations specifically examining biofeedback employed thermal biofeedback as their feedback modality. Only one of these studies (Labbe & Williamson, 1984), however, employed a between-group design that provided evidence for the efficacy of biofeedback as an intervention strategy when compared to waiting list controls. In this study, the treatment protocol and characteristics of the sample were clearly specified. The six other studies, which employed either uncontrolled group (Grazzi, Leone, & Bussone, 1990; Hermann, Blanchard, & Flor, 1997), multiple baseline (Allen & McKeen, 1991; Burke & Andrasik, 1989; Labbe & Williamson, 1983), or comparisons of clinic-based versus home-based therapy (Guameri & Blanchard, 1990) designs, provide supplementary evidence for the efficacy of biofeedback in the treatment of recurrent headache.

Four of the seven studies in this area treated samples diagnosed with migraine headaches. The remaining three studies involved either tension headaches or mixed groups. Results indicated equal effectiveness for home-based and clinic-based biofeedback interventions as well as no differences in
effectiveness based on duration of the interventions. Six of the seven investigations reported maintenance of therapy gains at various follow-up intervals, up to 2 years.

**Comparative Efficacy of Biofeedback and Relaxation/Self-Hypnosis**

Seven studies employed designs that either directly compared the relative effectiveness of biofeedback and relaxation/self-hypnosis or tested combined interventions. Only two of these studies (Fentress, Masek, Mehegan, & Benson, 1986; Labbe, 1995) used randomized control group designs comparing different combinations of biofeedback and relaxation/self-hypnosis to a waiting list control group. In each of these studies, the characteristics of the subjects and the treatments were clearly specified. Labbe provided evidence for greater effectiveness of autogenic relaxation compared to biofeedback for the treatment of vascular and migraine headache, while Fentress et al. found biofeedback and relaxation to be equally effective compared to controls for the treatment of migraine. Treatment gains in both studies were maintained at follow-up. The remaining five investigations utilized multiple baseline (Engel & Rapoff, 1990; Labbe & Ward, 1990) or retrospective case report (Olness & MacDonald, 1981; Smith, Womack, & Chen, 1989; Werder & Sargent, 1984) designs. Diagnoses of migraine (Olness & MacDonald, 1981), muscle contraction (Labbe & Ward, 1990; Smith et al., 1989; Werder & Sargent, 1984), or a combination of migraine, tension, or mixed headaches were specified (Engel & Rapoff, 1990); Werder and Sargent examined the efficacy of treatment for migraine, tension, and migraine/tension separately. Each study employed combined relaxation and biofeedback treatments and indicated initial improvement, as well as at least some maintenance of gains at varying follow-up intervals of up to 1 year following treatment termination.

**Other Intervention Studies**

Six other investigations addressed combinations of therapies to treat recurrent pediatric headache. All but one of these studies examined migraine headaches alone; Waranch and Keenan (1985) examined migraine and migraine plus muscle contraction headache. Three of these studies evaluated combinations of biofeedback and relaxation therapies combined with either cognitive (Helm-Hylkema, Orlebeke, Enting, Thijsse, & van Ree, 1990) or contingency management procedures (Mehegan, Masek, Harrison, Russo, & Leviton, 1987; Waranch & Keenan, 1985). Contingency management may be a particularly important intervention to employ with parents as change agents for younger recurrent headache patients to decrease the frequency of pain-related behaviors and associated disability and to increase the frequency of pain-free intervals. However, the designs in each of these investigations were not well controlled, with one retrospective study and the other two studies employing multiple baseline designs. Marked reductions in headache activity and maintenance of gains at follow-up as long as 22 months were reported. Two investigations evaluated the combination of relaxation training and cognitive (Richter et al., 1986) or contingency management procedures (Kapelis, 1984). The former study was a randomized, placebo-controlled trial that reported superior outcomes for cognitive coping and relaxation interventions at initial posttest and at 16-week follow-up. The latter study was an uncontrolled pre-post design with a small number of subjects that reported elimination of headaches for all subjects as a function of the intervention program. One final multiple baseline single case study evaluated the utility of school- and home-based contingency management (Ramsden, Friedman, & Williamson, 1983) on a 6-year-old child with migraine. Headaches were eliminated as a function of the intervention and positive changes were maintained at follow-up.

**Conclusions and Recommendations for Future Intervention Research**

Sufficient evidence exists from treatment outcome studies to conclude that relaxation/self-hypnosis is a well-established and efficacious treatment for recurrent pediatric migraine and tension headaches. Furthermore, enough evidence exists to conclude that thermal biofeedback alone is a probably efficacious treatment, and some argument can be made that it should be included as a “well-established treatment” for migraine headache. Although promising, studies that combine biofeedback and relaxation/self-hypnosis or compare the two interventions are not methodologically adequate to make a clear determination regarding the efficacy of these combined interventions. Other combined treat-
ment interventions are even less well supported by the literature, with evidence not currently available for determination as a promising intervention. There is generally greater evidence supporting the efficacy of psychological approaches for migraine than for tension or mixed headaches in children and adolescents. Based on the results of this review, several recommendations can be made regarding future intervention research in pediatric headache.

First, traditional dichotomous distinctions between migraine and tension headache have been challenged based on the notion that individuals may suffer from several different types of headaches with symptom presentations varying across time. Furthermore, chronic daily headache has emerged as an important new diagnostic category (Silberstein, Lipton, Solomon, & Mathew, 1994) that may have particular relevance in pediatric populations (Gladstein & Holden, 1996; Gladstein, Holden, Winner, & Linder, 1997; Holden et al., 1994). Although the treatment research published to date has clarified the diagnostic status of participants, continuing to investigate the efficacy of behaviorally based treatment strategies by placing subjects into groups of migraine, tension, or mixed headache does not adequately address the more recently described diagnostic categories. Research that evaluates the efficacy of intervention for other more treatment-recalcitrant types of diagnostic categories such as chronic daily headache should be pursued. Furthermore, it may be important to address changes in specific headache symptoms as a function of behavioral intervention independent of diagnostic categories. In addition, research that matches specific intervention strategies to well-defined subgroups in the context of randomized clinical trials to test specific treatment outcome hypotheses beyond general efficacy is highly recommended. We are just beginning to address the issue of variables that moderate treatment outcome in children (Hermann et al., 1997). Understanding which treatments are effective for different types of headaches under varying conditions is an important goal for future investigations.

Second, there is a clear need to move research in pediatric headache in the direction of comparing behavioral interventions to pharmacological interventions. Only two of the investigations reviewed provided data on this topic. As noted previously, a recent meta-analysis of the pediatric headache treatment literature indicated that effects sizes associated with psychological treatment are greater than those found for pharmacological intervention (Hermann et al., 1995). Furthermore, recent research with adults has indicated that combined psychological/pharmacological approaches may be more effective than either treatment approach alone (Holroyd et al., 1995). The important questions for the future of intervention for both pediatric and adult headache (Blanchard & Diamond, 1996) involve the evaluation of the combined effects of behavioral and pharmacological intervention strategies, simultaneously or successively, not only on short-term treatment outcomes but also on long-term maintenance of gains. For the treatment of migraine headaches, researchers may wish to compare the effects of behavioral approaches to those of analgesic medications (Hamalainen, Hoppu, Valkeila, & Santovuori, 1997), abortive medications such as sumatriptan, or prophylactic drugs such as low-dose tricyclic antidepressants (Solomon, 1995). Future studies should examine not only the statistical significance but also the clinical significance of treatment effects, as well as the moderator variables that influence short- and long-term outcomes (Labbe, 1995).

Third, multisite trials are needed to improve sample sizes, increase statistical power, and increase the generalizability of results obtained beyond the single settings in which intervention research for pediatric headache has been conducted to date. Research consortia could be easily established between pediatric headache centers to facilitate the actualization of this recommendation. This would also further the understanding of long-term outcomes within the context of developmental models of pediatric headache. Factors that influence maintenance of treatment effects (Hermann et al., 1997) and the impact of booster sessions could be readily investigated within the context of large, multisite trials. Before multisite trials can be conducted, treatment manuals need to be written and tested.

Finally, the treatment outcome research in recurrent pediatric headache has grown substantially over the last 15 to 20 years. Evidence for efficacy of behavioral approaches and maintenance of therapeutic benefits now exists with the current challenge for clinical researchers to move beyond general efficacy trials and into the next generation of outcomes research. This will include investigating more refined questions about efficacy, as noted previously, but also about the effectiveness of these interventions in real-world settings and their efficiency or cost-effectiveness (Blanchard & Diamond,
Appendix: Summary of Intervention Studies

Relaxation/Self-Hypnosis


*Diagnostic criteria.* At least one headache during the pre-treatment period.

*Baseline.* Data collected during 3-week pre-treatment period was used to define sample, as well as provide baseline.

*Experimental design.* Pre-post controlled group design.

*Assessment measure.* Headache diary—frequency of recording unspecified.

*Treatment protocol.* School-based intervention administered by psychologist-trained teachers. Two study groups: (1) progressive relaxation training (PRT), ten 15-minute sessions (based on Jacobsen, 1983); (2) placebo training (PT) control group, ten 15-minute sessions of “concentration exercises.”

*Outcome.* No significant group effects noted at post training. PRT group had fewer headaches and shorter headache duration post training than pre training, but this group experienced increased headache intensity post testing. PT group had no significant pre-post differences.

*Follow-up.* No follow-up data reported.


*Subjects.* $N = 17$ (11 females, 6 males). Ages: 11–21 years. Ethnicity: 100% White, middle to upper class.

*Diagnostic criteria.* Diagnosis of migraine, tension, or mixed headache by board-certified neurologist.

*Baseline.* Not specified.

*Experimental design.* Long-term follow-up of randomized, controlled group design.

*Assessment measure.* Headache diary, recorded daily; structured interview.

*Treatment protocol.* Four groups (see Engel & Rapoff, 1990): (1) autogenic relaxation, (2) progressive relaxation, (3) treatment package, (4) controls.

*Outcome.* See Engel & Rapoff (1990) for initial study findings.

*Follow-up.* All treated subjects sustained decreases in headache activity at an average of 51 months post treatment.


*Subjects.* $N = 10$ (8 females, 2 males). Ages: 9–15 years ($M = 11.5$ years). Ethnicity: 1 Hispanic, lower SES; 9 Whites, middle to upper SES.

*Diagnostic criteria.* Diagnosis of migraine, tension, and mixed headache. Criteria not specified.

*Baseline.* Seven to twenty-five days.

*Experimental design.* Multiple baseline.

*Assessment measure.* Headache diary, recorded daily; parent- and self-report of satisfaction.

*Treatment protocol.* Relaxation therapy—standardized administration during 6 weekly sessions.

*Outcome.* Significant decreases in multiple headache indices and reported distress for 8 of 10 subjects.

*Follow-up.* No follow-up data reported.


*Diagnostic criteria.* Diagnosis of tension or combined tension and migraine headache by psychiatrist based on Vahlquist (1955) criteria and standardized headache questionnaire (Ekboen, 1976).

*Baseline.* Four weeks.

*Experimental design.* Randomized, controlled group outcome design.
Assessment measure. Headache diary, recorded 4 times daily (Blanchard, 1978).

Treatment protocol. School-based group treatment administered over 5-week period. Three groups: (1) self-help relaxation (SHR) based on Bernstein & Borovec (1973). Training manual and audio tapes distributed and home practice encouraged twice daily. Mean therapist contact = 3 hours. (2) Problem discussion (PD)—common psychological conflicts discussed. Mean therapist contact = 7 hours. (3) Self-monitor (SM)—no testing.

Outcome. SHR group significantly more improved than PD and SM on all headache activity variables.

Follow-up. Gains of SHR group were more pronounced at 5-month follow-up.


Diagnostic criteria. Diagnosis of tension or combined tension and migraine headache by psychiatrist based on Vahlquist (1955) criteria and standardized headache questionnaire (Ekbom, 1976). Additional criteria are specified.

Baseline. Four weeks.

Experimental design. Randomized, controlled design.

Assessment measure. Headache diary, recorded 4 times daily.

Treatment protocol. Three groups: (1) relaxation training group (REL)—9 sessions over a 5-week period with home practice strongly encouraged; (2) information contact group (INF)—9 sessions, subjects met with psychologist who provided general information about headaches without suggesting interventions; (3) self-registration group (SR)—no testing.

Outcome. REL group was significantly more improved than INF and SR groups on all headache variables. REL had greater than 50% reduction in headache activity. Nonsignificant trend for both REL and INF to be superior in reduction of medication intake.

Follow-up. Results “somewhat weakened” at 6-month follow-up.


Diagnostic criteria. Diagnosis of migraine, combination tension and migraine, or nonmigraine headache by psychiatrist according to Vahlquist (1955) criteria. Additional criteria are specified.

Baseline. Four weeks.

Experimental design. Randomized, controlled group design.

Assessment measure. Headache diary, recorded 4 times daily (Blanchard, 1982). Diary included hours absent from school.

Treatment protocol. Three groups: (1) therapist-assisted relaxation (TAR)—9 sessions over a 5-week period, small group during school with progressive relaxation training (Bernstein & Borovec, 1973); (2) self-help relaxation (SHR)—manual and series of 5 audio tapes (each 5–10 minutes long), testing occurred over 5 weeks; (3) self-monitor (SM)—no training. Booster sessions provided at 2 months post-training for TAR and SHR.

Outcome. TAR and SHR were equally more effective at reducing total headache activity than SM. Both TAR and SHR decreased frequency of headache complaints.

Follow-up. Training gains were maintained by both TAR and SHR at 5-month follow-up.


Diagnostic criteria. Diagnosis of tension or combined tension and migraine headache based on standardized headache interviews (Ekbom, 1976) and criteria suggested by the Ad Hoc Committee (1962). Additional criteria are specified.

Baseline. Three weeks.
Experimental design. Randomized group design with subsequent double-blind drug crossover.

Assessment measure. Headache diary, recorded 4 times daily.

Treatment protocol. Two groups: (1) self-help relaxation (SHR)—5 audio tapes and a complementing manual for home-based relaxation training; (2) waiting list controls, who later received training. Subsequent double-blind, prophylactic, drug crossover for all subjects.

Outcome. Significant improvement on multiple headache variables for the SHR group. Addition of medications did not produce significant improvements in headache activity above that of the SHR group.

Follow-up. No follow-up data reported.


Diagnostic criteria. Diagnosis of migraine by pediatric neurologist; minimum IQ of 80. Additional criteria are specified.

Baseline. Four weeks.

Experimental design. Randomized, controlled group design.

Assessment measure. Headache diary, recorded 4 times daily; patient report of treatment credibility.

Treatment protocol. Three groups: (1) relaxation training—6 weekly sessions (method based on Cautela & Groden, 1978); (2) placebo training—6 weekly sessions of nonspecific therapy related to emotions; (3) “own best efforts”—single session to explain headache diary and the role of headache triggers.

Outcome. Both SA and clinic-training groups showed significant headache improvement, with SA showing the greatest clinical improvement.

Follow-up. SA and clinic-training results were maintained at 1-month, 3-month, and 1-year follow-ups.


Diagnostic criteria. Diagnosis of classic migraine headache by pediatric neurologist; minimum IQ of 85. Additional criteria are specified.

Baseline. Four weeks.

Experimental design. Randomized, double-blind, placebo-controlled, single crossover comparison.

Assessment measure. Headache diary, recorded for each headache occurrence. Diary included days of absence from school.
Treatment protocol. Three groups: 1) placebo, placebo, self-hypnosis (SH); 2) propranolol, placebo, SH; 3) placebo, propranolol, SH. Baseline: 1-week run-in (placebo or propranolol), 10-week placebo or propranolol treatment (period 1), 1 week washout, 12-week placebo or propranolol treatment (period 2), 12 weeks of SH (5 sessions) (period 3).

Outcome. SH training resulted in fewer headaches than placebo and propranolol treatments, but no significant difference in headache intensity was recorded.

Follow-up. No follow-up data recorded.


Subjects. N = 10 (7 females, 3 males). Ages: 12–17 years (M = 13.5 years).

Diagnostic criteria. Diagnosis of migraine or muscle-contraction headache. Additional detailed inclusion and exclusion criteria are specified.

Baseline. Three weeks.

Experimental design. Randomized (sequentially assigned) controlled group design.

Assessment measure. Headache diary, recorded 4 times daily (Blanchard & Andrasik, 1985).

Treatment protocol. Two groups: (1) 8-session relaxation training group (Bernstein & Borkovec, 1973); (2) waiting-list control.

Outcome. Headache index significantly lower for training group than for control group. Post training, 60% of training group were improved, 20% were slightly improved.

Follow-up. At 1-month follow-up on 6 out of 10 subjects, 4 remained improved.

Biofeedback


Diagnostic criteria. Diagnosis of migraine headache without aura, based on IHS criteria (1988). Additional criteria were specified.

*Subjects.* N = 10 (5 males, 5 females). Ages: 12–15 years (M = 12.8 years).

*Diagnostic criteria.* Diagnosis of muscular tension headache according to Ad Hoc Committee Classification of Headache (not cited).

*Baseline.* Four weeks.

*Experimental design.* Pre-post, uncontrolled design.

*Assessment measure.* Headache diary, recorded hourly on a daily basis.

*Treatment protocol.* EMG biofeedback—twelve 30-minute sessions over 6 weeks, with home practice encouraged both during and after treatment phase.

*Outcome.* At end of treatment, 89% mean decrease in pain index reported.

*Follow-up.* At 1-year follow-up, 94.3% mean improvement reported.


*Subjects.* N = 17 (11 females, 6 males). Ages: 8–16 years (M = 10.9 years).

*Diagnostic criteria.* Diagnosis of migraine headache by pediatrician or pediatric neurologist based on Ad Hoc Committee (1962) criteria. Additional criteria specified.

*Baseline.* Four weeks.

*Experimental design.* Randomized, controlled group design.

*Assessment measure.* Headache diary that included school absences.

*Treatment protocol.* Two groups. (1) Clinic-based treatment: 10 sessions of thermal biofeedback over an 8-week period; no manuals were provided to subjects. (2) Home-based treatment: 4 sessions in clinic over an 8-week period for thermal biofeedback; subjects received manuals for home training. For both treatment groups, home practice was encouraged.

*Outcome.* Significant reduction in headache activity for both groups: 71% of clinic-based group improved; 33% of home-based group improved.

Follow-up. Based on data on 5 subjects, 4 showed improvement at 4-month follow-up, 1 showed no improvement.


*Subjects.* N = 32 (13 females, 19 males). Ages: 8–16 years (M = 11.6 years).

*Diagnostic criteria.* Diagnosis of migraine or mixed headache according to IHS (1988) criteria. Additional criteria are specified.

*Baseline.* Four weeks.

*Experimental design.* Pre-post, uncontrolled design.

*Assessment measure.* Headache diary, recorded hourly on a daily basis.

*Treatment protocol.* Thermal biofeedback in a home-based format; 4 therapist-administered and 4 child-administered manualized sessions over an 8-week period. Daily home-practice encouraged.

*Outcome.* Reported 63.5% improvement in headache activity and improvement on a number of other variables, including school absences.

Follow-up. No follow-up data reported.


*Subjects.* N = 3 (1 female, 2 males). Ages: 9–13 years.

*Diagnostic criteria.* Diagnosis of migraine headache by physician.

*Baseline.* Six, seven, and eight weeks.

*Experimental design.* Multiple-baseline design.

*Assessment measure.* Headache diary, recorded 4 times daily.

*Treatment protocol.* Skin temperature and EMG biofeedback and autogenic training for hand warming administered in 10 treatment sessions over periods of 7, 8, or 9 weeks. Subjects were instructed to practice at home.

*Outcome.* During final 3 or 4 weeks of treatment, subjects were headache free.

Follow-up. At 1-month and 2-year follow-up, treatment effects were maintained.
Follow-up. Gradual improvement on various headache indices at 1-, 3-, 6-, and 12-month follow-up.


Subjects. N = 18 (11 females, 7 males). Ages: 8–12 years.

Diagnostic criteria. Diagnosis of migraine headache. Additional criteria were specified.

Baseline. Four weeks.

Experimental design. Randomized, controlled study.

Assessment measure. Headache diary, recorded daily.

Treatment protocol. Three groups: (1) relaxation-response group (PMR, meditative relaxation, and pain behavior management), (2) relaxation-response and biofeedback group (frontal EMG biofeedback, meditative relaxation, and pain behavior management), (3) waiting list control group (controls seen at beginning and middle of study to submit data). Treatment groups seen for 9 sessions over 11-week period.

Outcome. Both treatments were superior to control and were equally effective in reducing headache activity.

Follow-up. Reduction in migraine symptoms produced by both treatments were maintained at 1-year follow-up.


Subjects. N = 2 (both female). Ages: 11 and 14 years.

Diagnostic criteria. Diagnosis of muscle-contraction headache by physicians according to Ad Hoc Committee (1962) criteria. Additional criteria were specified.

Baseline. Five and six weeks.

Experimental design. Multiple baseline.

Assessment measure. Headache diary, recorded daily. Diary included “down time,” recorded hourly.

Treatment protocol. Thermal biofeedback-assisted relaxation training administered in 5 weekly sessions. Home practice was encouraged.

Outcome. Reported 4%–56% increase in headache-free days.
sisted of 7 sessions over an 8-week period. Home practice of self-control relaxation was encouraged.

**Outcome.** Treatment was effective for both subjects in reducing headache symptoms.

**Follow-up.** Clinically significant improvement was maintained at 6-month and 1-year follow-up.


**Subjects.** N = 30 (13 females, 17 males). Ages: 8–18 years (M = 12 years).

**Diagnostic criteria.** Diagnosis of vascular or migraine headache by physician. Additional criteria were specified.

**Baseline.** Four weeks.

**Experimental design.** Randomized, controlled group design.

**Assessment measure.** Headache diary.

**Treatment protocol.** Three groups: (1) waiting list control—submitted headache diaries at weeks 5 and 7; (2) skin temperature biofeedback with autogenic relaxation training; (3) autogenic relaxation training only. Groups received 10 training sessions over a 7-week period.

**Outcome.** Both training groups demonstrated reduction in frequency and duration of headaches. Neither training group demonstrated a reduction in intensity of headache compared to the control group. Addition of biofeedback did not contribute to improvement beyond that associated with autogenic training.

**Follow-up.** Improvement in headache frequency demonstrated for both training groups at 1- and 6-month follow-up.


**Subjects.** N = 3 (2 females, 1 male). Ages: 9–13 years (M = 11 years).

**Diagnostic criteria.** Diagnosis of migraine headache by neurologist. Additional criteria were not specified.

**Baseline.** None specified.

**Experimental design.** Retrospective case reports.

**Assessment measure.** Self-report of headache activity.

**Treatment protocol.** Subjects taught self-hypnosis with and without concomitant feedback of peripheral temperature changes.

**Outcome.** All 3 subjects reported significant relief from symptoms.

**Follow-up.** Results were maintained at follow-up periods ranging from 4 months to 3 years.


**Subjects.** N = 100 (47 females, 53 males). Ages: 6–17 years (M = 12.4 years). Ethnicity: 98% White, with private medical insurance.

**Diagnostic criteria.** Diagnosis of migraine, tension, or mixed headache. Additional criteria were specified.

**Baseline.** None specified.

**Experimental design.** Pre-post, uncontrolled design.

**Assessment measure.** Headache diary, recorded daily; Stanford Hypnotic Clinical Scale for Children (SHCS-C).

**Treatment protocol.** Intake (SHCS-C) self-hypnosis training; minimum of 4 (M = 9.3) sessions of EMG and/or skin temperature biofeedback training; 7 subjects received muscle relaxation or meditation based on low SHCS-C scores.

**Outcome.** Improvement in frequency of headache reported by 76% of subjects; improvement in headache intensity reported by 93% of subjects. No significant differences among headache types or hypnotic receptivity.

**Follow-up.** No follow-up data reported.


**Subjects.** N = 31 (16 females, 15 males). Ages: 7–17 years (M = 14.4 years).

**Diagnostic criteria.** Diagnosis of migraine (M), tension (T), and combination (M/T) headache. Additional criteria were not specified.
Baseline. None specified.

Experimental design. Retrospective, uncontrolled design.

Assessment measure. Headache hours per week and amount of drug usage recorded.

Treatment protocol. Self-regulation treatment, including EMG biofeedback, PMR, autogenic phrases, self-awareness, guided imagery. Two-month training program with a mean of 7-hours therapist contact.

Outcome. M, T, and M/T groups demonstrated decrease in mean headache hours per week following training.

Follow-up. Improvement continued at 2-month, 1-year, and 2–3-year follow-up.

Other


Subjects. N = 1 (6-year-old, white, female).

Diagnostic criteria. Diagnosis of infantile migraine headache according to Prensky & Sommer (1979) criteria.

Baseline. School baseline = 4 weeks; home baseline = 9 weeks.

Experimental design. Multiple baseline-across-settings design.

Assessment measure. Headache ratings—made by teacher for headache at school, by mother for headache outside of school. Antecedents and consequences of headache were also reported.

Treatment protocol. Eight weeks of school and 9 weeks of home treatment. School treatment included differential reinforcement of nonpain behavior and punishment of headache reports. Home treatment was the same as that at school but without the punishment component.

Outcome. At post treatment, the child no longer reported headache.

Follow-up. At 10-month follow-up, remission was maintained at both home and school.
Outcome. Decline in headache activity after treatment in 3-, 6-, and 9-week baseline conditions. Fourteen of 18 subjects had greater than 90% reduction in headache activity. Two subjects had a greater than 50% reduction in headache activity.

Follow-up. Ten of 17 subjects maintained greater than 90% reduction in headache activity at 6-month follow-up. At 12 months, 9 subjects maintained greater than 90% reduction in headache activity.


Subjects. N = 5 (3 females, 2 males). Ages: 7–14 years (M = 11.1 years).

Diagnostic criteria. Diagnosis of migraine headache. Additional criteria were specified.

Baseline. Four weeks.

Experimental design. Non-randomized, pre-post, uncontrolled design.

Assessment measure. Headache diary, recorded daily.

Treatment protocol. Hypnosis and behavior management (2–6 [M = 5.2] individual sessions); self-hypnosis practice, 10–15 minutes daily; weekly reward for headache records and reduction of pain behaviors.

Outcome. All children reported no headache during the 4-week period following treatment.

Follow-up. At 10–33 months, decrease was maintained at an average of 1 headache per child, compared with the pre-treatment mean of 6.6 headaches per child.


Diagnostic criteria. Diagnosis of classical or common migraine headache by a neurologist; minimum IQ of 80. Additional criteria were specified.

Baseline. Four weeks.

Experimental design. Randomized, factorial design.

Assessment measure. Headache diary, recorded 4 times daily.

Treatment protocol. Three groups: (1) relaxation training that closely followed Cauthel & Groden (1978), with instructed daily practice; (2) cognitive coping—“thinking straight” program based on Horyod & Andrasik (1978) and Bakal (1982); (3) placebo—attention control.

Outcome. Relaxation and cognitive coping groups had significantly fewer headaches and less headache activity post treatment than did the placebo control group. Treatment groups did not differ from each other.

Follow-up. At a 16-week follow-up, differences were maintained.


Diagnostic criteria. Diagnosis of migraine headache, migraine plus muscle contraction headache, and tension headache by pediatric neurologists.

Baseline. None specified.

Experimental design. Retrospective study.

Assessment measure. Headache diary, recorded daily.

Treatment protocol. Combination of self-monitoring, behavioral counseling, and EMG and thermal biofeedback.

Outcome. Thirteen of 15 subjects reported marked reductions in headache frequency and intensity.

Follow-up. Treatment gains were maintained at 6–22 month follow-up periods.
**References**


