X. БИОУПРАВЛЕНИЕ В ТЕРАПИИ ГОЛОВНЫХ БОЛЕЙ

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BIOFEEDBACK TREATMENT OF RECURRENT HEADACHES IN CHILDREN AND ADOLESCENTS[1]

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Varied biofeedback approaches are available for children and adolescents who experience recurrent migraine and tension-type headaches. Biofeedback treatments receiving the greatest empirical support at present are thermal/autogenic feedback and EMG biofeedback. Other treatments show promise (BVP, Doppler, and CNV biofeedback). Although comparative data are limited, meta-analysis suggests that biofeedback treatment can rival outcomes obtained for medication. Improvements appear to exceed those found when similar procedures are applied to adults. A number of variables have been tentatively identified as predictors of treatment response. However, further research, investigating patient-treatment interactions, behavioral-pharmacological interactions and sequencing effects, varied modes of administration, the role of comorbid conditions, and setting effects (clinic vs research laboratory), is clearly needed. Consideration of developmental aspects is warranted as well.

***Key words**: pediatrics, migraine, tension-type headache, biofeedback.*

Introduction. Two types of behavioral treatments predominate in the headache literature: relaxation, and biofeedback, which is the focus of this chapter. Relaxation and biofeedback are similar in many respects, as both have as their chief aim the reduction of physiological arousal associated with stress and headaches and both typically incorporate the same types of adjunctive approaches (diaphragmatic breathing, mental imagery, etc.) to maximize effects. In clinical practice these two forms of treatment are often combined. Relaxation training uses what may be considered a "shotgun" approach (seeking to effect a broad or overall state of relaxation), whereas biofeedback uses a "rifle" or more focused approach (targeting specific response systems). The more precise focus of biofeedback has led investigators and clinicians to advocate for specific approaches for distinct headache types, which is the format we will follow in this chapter.

Biofeedback Defined. Many operational definitions have been proposed for biofeedback. Here we present the comprehensive definition of "applied biofeedback" provided by Olson [1] which attempts to synthesize the most salient points from several different existing theoretical accounts:

As a process, applied biofeedback is (1) a group of therapeutic procedures that (2) utilizes electronic or electromechanical instruments (3) to accurately measure, process, and "feed back" to persons (4) information with reinforcing properties (5) about their neuromuscular and autonomic activity, both normal and abnormal, (6) in the form of analogue or binary, auditory and/or visual feedback signals. (7) Best achieved with a competent biofeedback professional, (8) the objectives are to help persons develop greater awareness and voluntary control over their physiological processes that are otherwise outside awareness and/or under less voluntary control, (9) by first controlling the external signal, (10) and then with internal psychophysiological cues (p. 29).

The biofeedback movement in general can be traced back to the late 1960's and early 1970's, when a number of converging scientific findings and sociocultural trends fostered development of what was then viewed as a radically new approach to behavior change [2]. At this time, empirical studies were beginning to show that both human and animal subjects could be conditioned to control certain autonomic nervous system functions, such as blood pressure, salivation, gastrointestinal contractions, urine formation, sweat gland activity, vasomotor response, and cardiac activity [3-11]. The possibility that glandular and visceral responses, heretofore thought to function automatically and even unconsciously, could be influenced by conscious attempts of individuals opened the eyes of many medical and psychological visionaries. It was only a matter of time before clinical applications began to surface and among the first attempts were alternative ways to manage headache.

Biofeedback Training for Headache: Basis. ***Migraine.*** Four distinct biofeedback approaches have been investigated for migraine headache: (1) thermal biofeedback or autogenic feedback, by far the most common, (2) blood volume pulse biofeedback, (3) transcranial doppler biofeedback, and (4) contingent negative variation (CNV) biofeedback. These treatments were initially developed for adults, but subsequently

[1] *Source: V. Guidetti, G. Russell, M. Sillanpää, & P. Winner. Headache and Migraine in Childhood and Adolescence. London: Martin Dunitz, 2001*

they were found to be very beneficial for children and adolescents as well.

Thermal Biofeedback. Thermal biofeedback originated from a serendipitous finding at the Menninger Clinic in Topeka [12]. During a standard laboratory evaluation at this clinic, it was noted in one patient that spontaneous termination of a migraine attack was accompanied by flushing in the hands and a rapid, sizeable increase in surface hand temperature. This astute observation, combined with clinical creativity, led these researchers to pilot test whether teaching migrainuers how to increase their peripheral temperature voluntarily might afford patients some improved ability to regulate their headaches. In their early studies, highly sensitive temperature probes were attached to a patient's index finger and to the middle of the forehead. The temperature differential between these two probes was displayed to the patient, who then was instructed in ways to increase hand temperature relative to forehead temperature (the goal being to shunt blood flow in the head and redirect it to the extremities, based on the prevailing view of migraine being primarily a vascular disorder).

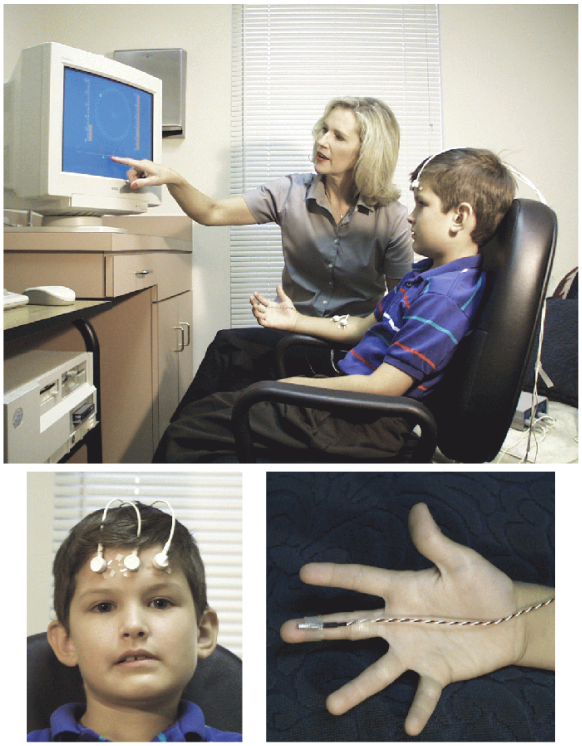


Fig. 1. *Child receiving thermal and EMG biofeedback. In the top panel, the therapist is explaining the feedback modalities to the child. The vertical bars on either side of the computer monitor are displaying EMG activity from the forehead and forearm. The circle in the middle and the bar on the bottom of the monitor are providing temperature (relative) feedback. Actual temperature values are provided digitally in the middle of the circle. The panel on the bottom left reveals a typical EMG electrode array placement for treatment of tension-type headache and generalized relaxation. The panel on the bottom right reveals a typical thermistor placement for monitoring surface skin temperature.*

This thermal biofeedback was combined with certain components of autogenic therapy in order to augment training effects, resulting in what was termed "autogenic feedback." Autogenic training has an extensive history [13] and involves having patients passively concentrate on key words and phrases selected for their ability to promote desired somatic responses. Specifically, patients were instructed to focus on feelings of warmth and heaviness in the extremities (two of the six components of autogenic therapy) to facilitate increased blood flow there. Initially, it was not known whether the temperature change occurring in patients was due to forehead cooling, hand warming, or both. Subsequent study revealed that most of the effect essentially was due to hand-warming, so most present-day biofeedback therapists monitor temperature from single peripheral sites, as depicted in Figure 1.

As will be seen in a subsequent section, an extensive literature supports the clinical utility of this approach (with patients of all ages). However, mechanisms underlying hand warming are not fully understood at present. Current theoretical accounts speculate that autogenic feedback [1] derives its effect indirectly from the decreased sympathetic nervous system arousal that must occur in order for peripheral dilatation and subsequent handwarming to take place and/or [2] serves to stabilize the vascular system and counteract vasomotor instability and perturbations, much like some prophylactic medications [14-16]. If the former account holds true, then autogenic biofeedback may well serve as yet another more generalized approach to relaxation.

Blood Volume Pulse Biofeedback. Hand-warming biofeedback remains the predominant biofeedback approach for researching and treating migraine in children, adolescents, and adults, but three other approaches have received some research attention. The first of these evolved from a more straightforward rationale and involves monitoring blood volume pulse (BVP) from the temporal artery to teach patients how to reduce or constrict blood flow to the temporal region. This technique for coping with migraine attacks is based on the seminal research of Wolff and colleagues [17], who found an association between pain and both extra- and intracranial artery dilatation during migraine attacks. Thus, this procedure may be thought of as the nondrug equivalent to ergotamine therapy.

The initial effectiveness of this biofeedback treatment was evaluated by Friar and Beatty [18]. Nineteen adult migraineurs, 18 of whom had reported prior treatment success with ergotamine tartrate, were carefully selected from a pool of 74 potential patients. Measures of blood flow were taken from pressure-transducing plethysmographs attached at two different sites - one directly above the temporal artery or to one of its main ramifications and the other to the ventral surface of the index finger. Subjects were matched carefully and assigned randomly to receive pulse-amplitude feedback from the temporal area (experimental group) or the finger (control group), both in the direction of decreased blood flow. At the completion of eight training sessions, experimental subjects were able to decrease blood flow in the temporal region by 20% during nonheadache periods. (It was not possible to train patients directly during an attack, so they needed to learn the vasoconstriction strategies during nonheadache intervals.) No significant changes in temporal blood flow occurred for the control

subjects. Experimental subjects improved by approximately 45%, versus 14% improvement for control subjects.

Friar and Beatty's procedures were very difficult to implement, as they required repeated calculations of pulse amplitude, skin temperature, pulse rate, and pulse propagation time. In addition, it was necessary to simultaneously monitor and correct for muscle activity artifact, via visual analysis and construction of a pulse-wave template from the previous session. Although these obstacles are now more easily overcome with computers and advanced software and sensors have been improved (reflectance plethysmography), other measurement difficulties continue to exist (varying reliability, inability to quantify values in an absolute sense). Consequently, research and clinical applications of BVP biofeedback lag far behind those for hand temperature biofeedback, especially as pertains to children and adolescents.

Sartory, Müller, Metsch, and Pothmann [19] have conducted the only controlled evaluation of the utility of BVP with pediatric headache. Juvenile headache sufferers (migraine and nonmigraine), between the ages of 8 and 16, were randomly assigned to receive BVP biofeedback (combined with stress management training), relaxation training (also combined with stress management training), or metoprolol (a beta-blocker). Biofeedback resulted in significant improvements with regards to headache frequency, headache duration, and mood state. Consumption of analgesics decreased considerably (approximately 40%), but this change was not found to be statistically significant. Similar findings occurred for relaxation (significant improvements for frequency and intensity), with a greater proportion of patients in this condition being judged overall as clinically improved. No significant changes occurred for the beta-blocker medication. These effects endured at the 8-month followup. Children receiving BVP feedback reduced blood flow in the temporal artery 6-8% on average, which contrasts markedly with the reductions reported by Friar and Beatty [18] with adults (20%). Time devoted to BVP biofeedback was minimal in Sartory et al [19]. Perhaps outcomes would have been improved if subjects had been provided increased opportunities to become more proficient with BVP regulation.

Other Biofeedback Approaches. The two other biofeedback approaches for migraine are experimental and remain under development. The first involves transcranial doppler technology in attempts to affect blood flow in the middle cerebral artery [20]. This approach is based on the observations of Friberg, Olesen, Iversen, and Sperling [21], who found that migraine pain was due to, or at least closely associated with, intracranial large artery dilatation. Parameters under investigation concern mean blood velocity and peripheral resistance index (systolic minus diastolic divided by diastolic). This research appears to be confined to adults at present. The newest biofeedback approach for pediatric migraine directly targets central nervous system parameters and involves self-regulation of slow cortical potentials (contingent negative variation, CNV) in the EEG [22]. This treatment, like BVP and doppler biofeedback, requires special therapist expertise and equipment and likely will remain experimental for some time.

Tension-type headache. Electromyographic (EMG) biofeedback is by far the main biofeedback treatment for tension-type headache. In this treatment, EMG electrodes are typically attached to the surface of the forehead (see Figure 1), the patient is given easily processed information about the ongoing level of muscle activity in this area (via an auditory tone that is directly proportional to the electrical activity recorded), and the therapist coaches the use of strategies to facilitate relaxation and reductions in tension levels [23]. At the time this procedure was developed, it was widely believed that sustained muscular contractions were the chief cause of tension-type headache and that tension level in the frontal area served as a good barometer for tension elsewhere in the body, especially for head, neck, and shoulder muscles. Current day EMG biofeedback approaches to tension-type headache include more extensive, individualized assessment so that treatments can be tailored to a greater extent. For example, varied muscles are sampled (e.g., bilateral frontal-posterior neck electrode placement, scanning of multiple sites), recordings are dynamic as well as static (taken during movement and postural changes as well as at rest), and, occasionally, readings are taken in real life settings (via ambulatory monitoring) [24].

Research has shown that a number of cognitive and behavioral changes occur when patients undergo EMG biofeedback (e.g., confidence in coping abilities enhances, self-efficacy increases, and these in turn lead the patient to attempt to cope in a more active manner), in addition to improved abilities to regulate tension levels [25-27]. These changes may well serve important mediating functions [28]. This may help explain the positive treatment effects observed for tension-type headache patients who lack evidence of pericranial muscle involvement, yet still benefit from EMG treatment.

In adult patients, brain wave and electrodermal biofeedback have been piloted, but we could find no such work with child or adolescent tension-type headache sufferers. Hence, we will not review these approaches here.

To facilitate discussion, we have presented biofeedback as distinct treatments for distinct headache types. In practice, clinicians often employ multiple forms of biofeedback, along with related complementary behavioral approaches and medication, because a sizeable percentage of individuals with headache experience overlapping symptoms and other complicating conditions.

Evidence Base.

Migraine. Two recent articles contain extensive reviews of the literature for the major biofeedback approaches for pediatric headache: thermal/autogenic feedback and EMG biofeedback. The first [29] culled all available drug and nondrug studies for pediatric migraine through early 1993 and selected for analysis only those studies meeting explicit predetermined criteria to ensure that adequate designs and sample sizes were employed, that duplication of subjects and repetition of findings

were avoided, and that samples were not specially selected. The resulting 17 behavioral treatment studies and 24 pharmacological studies were then entered into a meta-analysis which permitted the investigators to statistically evaluate how various nonpharmacological treatments compared to one another, how various pharmacological prophylactic approaches compared to one another, and how these two forms of treatment compared to each other. The findings from this meta-analysis are presented graphically in Figure 2, which lists the results in decreasing order of obtained effect sizes (for data with outliers excluded), and in Table 1, which reports all possible paired statistical comparisons (drawn from Table 4 of the authors [29]).

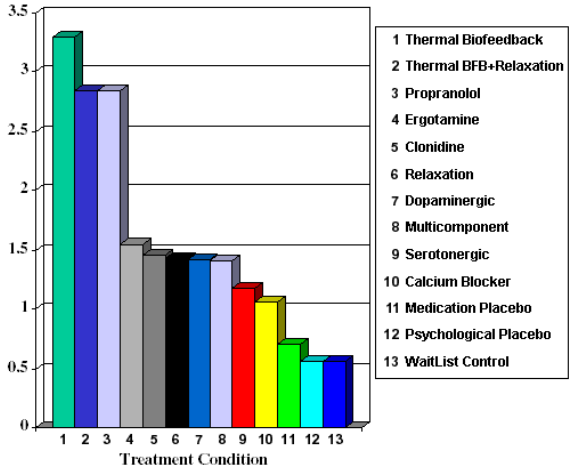
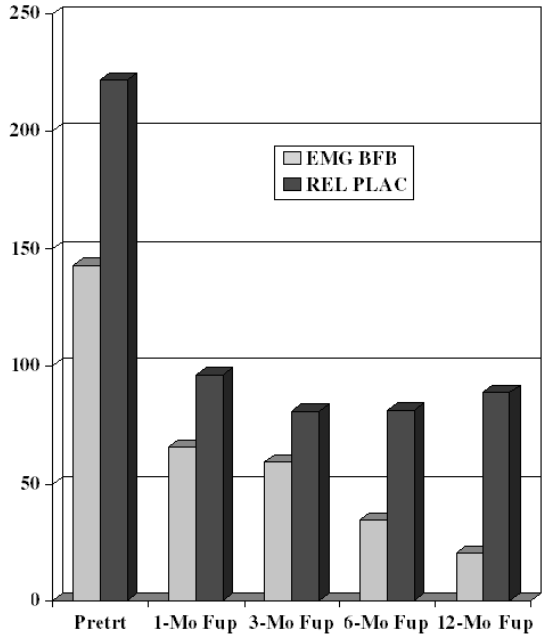


Fig. 2. *Effect size values for behavioral (n = 17) and pharmacological (n = 24) treatment for pediatric migraine. Data derived from Hermann et al [29]. (BFB = biofeedback; Multicomponent = a combination of 3 or more behavioral treatments).*

To illustrate how to interpret Table 1, first consider thermal biofeedback. Comparing down the column, it is learned that outcomes from this treatment exceeded those obtained by multicomponent treatments (at least 3 or more distinct behavioral treatments combined), active medications (calcium channel blockers and serotonergic agents), psychological and drug placebos, and no treatment controls. The addition of relaxation training (BFB+PMR) did not add appreciably to effectiveness, but this combination exceeded all other treatment and control conditions. Of additional interest is the finding that both active medications exceeded drug placebo. Data for other medications (propranolol, dopaminergic drugs, ergotamine, and clonidine) were too limited to permit meaningful analyses in the primary comparisons. Thus, thermal/autogenic feedback was shown to be highly efficacious for pediatric migraine.

The second, and more recent, review article examined 31 behavioral studies for the extent to which they met what have become fairly standard criteria for determining efficacy for psychologically-based interventions (based on seminal work by a task force for the clinical psychology division of the American Psychological Association [30]). The criteria utilized by Holden, Deichmann, and Levy [31] are reproduced in Table 2. These authors came to similar conclusions regarding the efficacy of thermal biofeedback for pediatric migraine upon examining the available evidence. As previously mentioned, the data base is too limited to permit definitive statements about efficacy of BVP, Doppler, and CNV biofeedback for pediatric headache.

Tension-type headache. Investigations are far more limited for tension-type headache with children and adolescents and only one of the two previously cited literature reviews addressed this headache type. This most recent review [31] uncovered only a small number of studies researching EMG biofeedback for tension-type headache alone (not combined with migraine features); all identified studies were published prior to 1991. Perhaps the strongest support for EMG biofeedback comes from a few recent studies that have been able to recruit fairly large sample sizes and collect longer term followup. In the first, Bussone, Grazzi, D'Amico, Leone, and Andrasik [32] randomly assigned juveniles to either EMG biofeedback (assisted by relaxation training, n = 20) or relaxation placebo (n = 10). In the placebo condition, EMG recordings were made but no feedback was provided; patients were instructed to remain calm and attempt to become more and more relaxed, by whatever means possible for them. At the completion of treatment, both conditions led to sizeable reductions (approximately 50%). Over time, however, children in the biofeedback condition continued to improve, while those assigned to placebo did not. At 6- and 12-month followup, improvements shown by the biofeedback group statistically surpassed



those for the placebo group (see Figure 3).

Fig. 3. *Mean Pain Total Index scores for EMG BFB-assisted relaxation and relaxation placebo (REL PLAC) from pretreatment through 12-month followup.*

Patients in this study were not instructed to practice biofeedback and related relaxation skills outside of therapy, and this may help explain the delayed onset to maximum symptom relief.

The efficacy of EMG biofeedback for tension-type headache in children and adolescents was replicated in a subsequent single group outcome study (n = 38), with results holding through three years [33].

Tab. 1
Significance of the within-group effect size differences across the different behavioral and pharmacological treatments

	Thermal BFB	BFB	BFB+ PMR	Multicom-ponent treatment	Psycholo-gical placebo	WaitList	Calcium blockers	Seroto-nergic drugs	Drug placebo
Thermal BFB	----								
PMR	>**	---							
BFB+PMR	n.s.	>**	---						
Multicomponent treatment	>**	n.s.	>**	---					
Psychological placebo	>**	>**	>**	>**	---				
WaitList	>**	>**	>**	>**	n.s.	---			
Calcium blockers	>**	n.s.	>**	n.s.	>**	>**	----		
Serotonergic drugs	>**	n.s.	>**	n.s.	>**	>**	n.s.	----	
Drug placebo	>**	>**	>**	>**	n.s.	n.s.	>*	>**	----

Reprinted from Hermann et al. [29]. Permission pending.
The unequality signs refer to the comparison between columns and rows (e.g., considering the first column, Thermal BFB was found to be superior to PMR, multicomponent, psychological placebo, wait list, calcium blockers, serotonergic drugs, and drug placebo; the addition of PMR to biofeedback did not significantly enhance effects). The comparisons were based on the mean ES for each treatment category after removal of outliers.
*$p < 0.05$; ** $p < 0.01$.
BFB = biofeedback; PMR = progressive muscle relaxation

Tab. 2
Criteria for determining efficacy of psychological treatments (Holden et al. [31])

Well Established	•Tested in a randomized group designs, wherein Treatment is superior to placebo or alternative treatment Statistical power is adequate •Or, a large series of appropriately controlled single-case design experiments, wherein Treatment is superior to placebo or alternative treatment • effects demonstrated by at least 2 different investigative teams • treatment must be well specified • samples must be adequately described
Probably Efficacious	•2 or more randomized group designs, wherein «treatment is superior to a wait list control •Or, 1 study that meets the criteria for a well-established intervention
Promising Intervention	•Positive support from 1 well-controlled study and at least 1 other less well-controlled study •Or, a small number of single-case design experiments •Or, 2 or more well-controlled studies by the same investigative team

As was true for Bussone et al. [32], patients continued to improve over time. Finally, Kröner-Herwig, Mohn, and Pothmann [34] found EMG biofeedback to be efficacious, too, but their sample included subjects who had combined headache in addition to pure tension-type headache.

Thus, it is not possible to determine how each subsample fared. Taken together, though, these reports support the utility of EMG biofeedback for episodic tension-type headache, but further investigation is needed before more definitive claims can be made. In future research it will be important to separate the effects for biofeedback and relaxation alone, as most of the preceding studies combined these two components.

Clinical Considerations. Biofeedback treatments for headache were developed and field-tested with adult patients. When investigators began to turn their attention to children and adolescents, the treatments were applied with few adjustments and appeared to meet with even greater clinical success than when comparable procedures were performed with adults. To date, no direct comparisons of child and adult headache patients have been conducted within a single study. However, a recent quantitative analysis [35], drawing upon nearly 60 existing separate child and adult studies, confirmed that children indeed have improved at a greater level when treated in a similar fashion with either temperature or EMG biofeedback (see Figure 4).

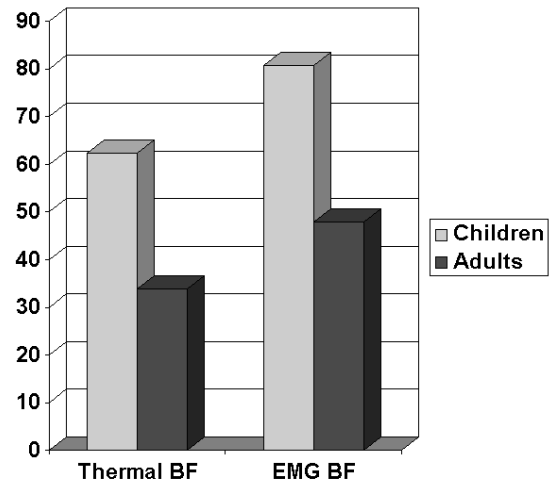


Fig. 4. *Mean percentage improvement in headache activity for children and adults treated by thermal and EMG biofeedback (data from Sarafino and Goehring [35]). Values are subject-weighted means. The number of subjects and the number of studies upon which the values are based are as follows: Children-Thermal BF (65/6), Children-EMG BF (19/4), Adults-Thermal BF (243/15), and Adults-EMG BF (238/25).*

These very encouraging findings for juveniles may need to be tempered somewhat, because it is possible that children and adolescents may have a higher rate of spontaneous remission than adults [35]. Few investigators have examined this aspect, but it does need consideration.

Tab. 3
Advantages and disadvantages when treating children by biofeedback. From Attanasio et al. [36]

Advantages	Increased enthusiasm Quicker rate of learning Less skeptical about self-control procedures Greater confidence in special abilities Increased psychophysiological lability Fewer previous failure experiences with treatment Increased enjoyment when practicing Increased reliability of symptom monitoring
Disadvantages	Briefer attention span Off-task behaviors during session Fear/apprehension about equipment Intolerant of minor discomfort in removing sensors Emotional/psychological problems Reduced ability to comprehend rationale/procedures Scheduling problems Lack of standardized electrode placement

From our clinical experience after working with 100+ children and adolescents, ranging in age from 6 to 17, we [36] identified a number of advantages in working with younger individuals, which may help account for their enhanced treatment response. At the same time, certain difficulties were encountered (see Table 3).

These potential problems are easily addressed by tailoring language and taking additional time to ensure understanding, decreasing the amount of time spent practicing biofeedback within sessions (e.g., 20 minutes total with children versus 30-40 minutes for adults and inclusion of frequent rest periods if needed), and by employing contingent management strategies to help sustain performance. In trying to follow standardized protocols, which is crucial in research investigations, we found that multiple modifications were required for children aged 7 and below. The modifications were such that it became very difficult to determine with any certainty what components were being most helpful.

Green [37] presents a number of very helpful suggestions and verbatim scripts to use when teaching self-regulatory skills to very young children. Some of her specific recommendations include the following: invite the entire family to the initial session to prevent the child from being singled out as the problem or "sick one"; have the therapist be identified as a "biofeedback teacher," someone who teaches ideas and skills, who likes to be asked questions, and who in turn likes to ask questions; demonstrate biofeedback with a response that is easily controlled or produces a quick, discernible response (EMG from the forearm, because it can be manipulated very easily; electrodermal response when playing guessing games); and incorporate adjunctive techniques (belly or diaphragmatic breathing, body scanning, imagery).

It is evident that each approach is of value to child and adolescent headache patients. With adults, there is the suggestion that some patients may respond differentially to relaxation and to biofeedback [38]. Unfortunately, there are no data at all to guide therapists in selecting and sequencing which approach to apply for a given child/adolescent patient. Until such critical data are collected, choice defaults to therapist and patient preference. Some therapists believe that children lacking in motivation may respond better to biofeedback because of the immediacy of feedback and its game-like, futuristic, and technical qualities.

Although fairly straightforward translations of biofeedback treatment approaches have met with much success, it is possible that effects could be enhanced further by adding a developmental perspective to evaluation and treatment. Marcon and Labbé [39] discuss cognitive, self-regulation, and psychosocial factors and issues that arise at various stages of development. One example they discuss, illness causality, is presented here for purposes of illustration.

To the question, "How do people get headaches?" they point out that children proceed from no to minimal comprehension ("from God"), to external causality and concrete explanations ("from running and getting hot"), to internal and physiological understanding ("from things happening to you that cause too much blood flowing to your head"), and lastly to psychophysiological explanations ("when people get nervous or do too much, this causes their body to react, with a headache").

It can readily be seen how these varied illness conceptualizations would impact treatment delivery. Other examples discussed by Macon and Labbé concern differences in language, time perception, and approaches to tasks and varied abilities to comprehend the notion of severity. They also point to the importance of considering environmental influences on headache, specifically attention from family members and teachers.

Tab. 4
Pain behavior management guidelines for parents (Allen and Shriver [40])

Encourage independent management of pain:	Praise and publicly acknowledge practice of self-regulation skills during pain-free episodes. If pain is reported, issue a single prompt to practice self-regulation skills. Praise and reward normal activity when report of pain has been made
Encourage normal activity during pain episodes:	Insist upon attendance at school, maintenance of daily chores and responsibilities, participation in regular activities (lessons, practices, clubs)
Eliminate status checks:	No questions about whether there is pain or how much it hurts
Reduce response to pain behavior:	No effort should be made to assist the child in coping. Do not offer assistance or suggestions for coping. Do not offer medications
Reduce pharmacological dependence:	If medication is requested, deliver only as prescribed (i.e., follow directed time table)
Recruit others to follow same guidelines:	School personnel should not send child home; child should be encouraged and permitted to practice self-regulation skills in the classroom, workload should not be modified
Treat pain requiring a reduction in activity as illness:	If school, activities, chores, or responsibilities are missed, the child should be treated as ill and sent to bed for the remainder of the day, even if pain is resolved. Do not permit watching television, playing games, or special treatment

Allen and Shriver [40] recently provided a concrete illustration of this latter point. Child and adolescent migraineurs, ranging in age from 7 to 18, were randomly assigned to one of two treatment conditions: standard thermal biofeedback or biofeedback combined with parent training in pain behavior management. In the latter condition, parents were taught to (1) minimize their reactions to pain behavior, (2) insist upon participation in normal, planned activities, and (3) praise and support biofeedback practice. Specific written guidelines were distributed to parents and reviewed at each session (see Table 4).

Thermal biofeedback, as expected, led to significant improvements, thus providing a further replication of the efficacy of this approach. However, the addition of parent pain behavior management training added a significant increment to clinical outcome. The combined treatment group achieved greater overall reductions in headache frequency, had a larger percentage of patients displaying clinically significant improvement (reductions greater than 50%), and better adaptive functioning (i.e., pain led to less interference in daily activities).

As is true for all treatments, medical and non-medical alike, no one approach benefits all patients equally. This has led to the search for variables that are predictive of or associated with clinical outcome. The following have surfaced as tentative predictors of enhanced treatment response. They are labeled as "tentative" because they have yet to be cross-validated/replicated in varied settings and by different investigators: greater externalizing behavior (acting out, impulse control), psychosomatic distress, home practice, unhappiness at home and/or at school, and headache severity; lesser age, chronicity, and maternal reinforcement of illness behavior [41-43].

Health care costs continue to increase and treatments such as biofeedback can become quite expensive. In published studies, patients are typically seen in 8-12 one-hour individual sessions. In clinical practice, complicated cases may remain in treatment even longer. As a way of controlling costs, investigators working with adult headache patients have begun to explore more cost-effective and cost-competitive ways to administer treatments. The two primary approaches have been group administration [44] and home-based or minimal-contact delivery [45, 46]. The typical reduced-contact treatment involves only 3-5 office visits, with treatment supplemented by written training manuals and audiocassettes to use in home instruction. In addition to saving time and money, there are many theoretical and practical advantages to such an approach and few disadvantages [47]. Pilot investigations with pediatric migraineurs suggest that autogenic feedback may work equally well when delivered in a reduced-contact mode, with either the child or parent serving as the main treatment agent for the home instruction [48]. Therapist skill level may become increasingly important, as time with the patient is reduced. Andrasik, Oyama, and Packard [49] review various factors that need consideration when selecting biofeedback therapists (such as training level, credentials, personal characteristics, etc.). Biofeedback therapists can be characterized as "general practice (GP) biofeedback clinicians" or "biofeedback specialists" [50, 51]. The GP biofeedback clinician is the most common in practice settings, and this therapist is typically familiar with EMG, thermal, and electrodermal approaches for reducing excess physiological arousal. This is fortunate, as these are by far the most common biofeedback approaches for pediatric headache. EEG and Doppler biofeedback would fall into the realm of the biofeedback specialist and such therapists are far fewer in number and much less available.

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БИОУПРАВЛЕНИЕ В ЛЕЧЕНИИ ХРОНИЧЕСКИХ ГОЛОВНЫХ БОЛЕЙ У ДЕТЕЙ И ПОДРОСТКОВ[1]

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При лечении детей и подростков, страдающих мигренями и головными болями напряжения, используются различные методы биоуправления. Наибольшую эмпирическую поддержку среди этих методов в настоящее время имеет биоуправление по температуре и ЭМГ. Существуют и другие, также перспективные, методы - биоуправление по пульсовому кровенаполнению, биоуправление по кровенаполнению с использованием транскраниальной допплеровской технологии, биоуправление по медленным корковым потенциалам с использованием условного негативного отклонения. Несмотря на ограниченный объем сравнительных данных, мета-анализ показывает, что по своей результативности методы биоуправления могут конкурировать с медикаментозным лечением. Улучшение состояний у детей происходит более заметно, чем у взрослых, при прохождении аналогичных процедур биоуправления. В качестве предикторов лечебных эффектов был предложен экспериментальный ряд переменных. Необходимы дальнейшие исследования бихевиоральных и фармакологических способов воздействия и их последствий, различных методов организации лечения, роли коморбидных факторов и влияния условий, в которых проводится лечение.

Ключевые слова: *педиатрия, мигрень, головные боли напряжения, биоуправление.*

Основные методы биоуправления в лечении головных болей. При лечении повторяющихся мигреней и головных болей напряжения у детей и подростков используются различные методы биоуправления. В настоящее время наибольшее эмпирическое подтверждение получило биоуправление по температуре и ЭМГ. Обнадеживающие результаты достигнуты также при использовании биоуправления по пульсовому кровенаполнению (blood volume pulse, BVP), биоуправления по кровенаполнению внутричерепных артерий с использованием транскраниальной допплеровской технологии (transcranial doppler biofeedback), биоуправления по медленным корковым потенциалам с использованием условного негативного отклонения (contingent negative variation, CNV). Все эти

[1] *Реферат подготовлен О.Ю.Лазаревой.*

методики изначально были разработаны для взрослых пациентов, но впоследствии показали свою эффективность и в педиатрии.

Мигрень. Преобладающим подходом в этом случае является биоуправление по температуре. Существует обширная литература, подтверждающая клиническую эффективность этого подхода. Биоуправление по пульсовому кровенаполнению основывается на исследованиях, обнаруживших связь головных болей с расширением как внутричерепных, так и внечерепных артерий во время приступов. С помощью мониторинга пульса кровотока в височной артерии пациенты обучаются контролировать кровоток в височной области, связанный с возникновением приступов. Эти процедуры можно рассматривать как нелекарственный эквивалент терапии эрготамином.

С помощью транскраниальной допплеровской технологии делаются попытки управлять кровотоком в средней мозговой артерии. Параметры управления – скорость кровотока и периферический индекс сопротивления. Этот подход основывается на клинических наблюдениях связи мигренозных болей с расширением крупных внутричерепных артерий. Новейшие подходы в биоуправлении связаны с параметрами ЦНС и включают саморегуляцию медленных корковых потенциалов. Однако перечисленные методы (BVP, doppler и CNV) требуют специального врачебного опыта и оборудования и возможны пока только в экспериментальной форме.

Головные боли напряжения. В этих случаях в основном применяется биоуправление по ЭМГ. В настоящее время арсенал методик расширился, позволяя максимально учитывать индивидуальные условия. Например, воздействие включает различные группы мышц, мониторинг проводится как в статике, так и в динамике, зачастую в реальных условиях (в отличие от амбулаторных). Исследования показывают, что наряду с улучшением способностей регулировать уровень мышечного напряжения у пациентов происходят позитивные изменения на когнитивном и бихевиоральном уровнях (например, возрастание доверия к своим способностям, рост самоэффективности приводят к дальнейшему повышению активности пациента в работе) [25-27]. Эти изменения могут служить важными функциями-посредниками, в какой-то степени объясняющими наличие позитивного результата лечения у тех пациентов, которые при работе не продемонстрировали включения перикраниальных мышц.

Анализ существующих в литературе данных. Представленные ниже данные различных исследователей подтверждают эффективность температурного и ЭМГ биоуправления в педиатрической практике лечения мигреней и головных болей напряжения.

Мигрень. В двух исследованиях [29, 30] содержатся обзоры литературы по различным подходам к лечению педиатрических головных болей. Hermann et al. [29] провел мета-анализ исследований педиатрических мигреней, которые подходили под определенные, заранее заданные критерии. Были отобраны 17 бихевиоральных и 24 фармакологических подходов к лечению. Результаты анализа графически представлены на рис.2, в виде убывающего ряда эффектов, полученных от различных подходов, и в табл.1, где показаны все возможные парные статистические сравнения эффектов от этих подходов. В более поздней работе [31] исследовалось, насколько выбранные бихевиоральные практики лечения отвечают разработанным критериям эффективности психологических вмешательств (см. Табл. 2). Обе работы подтверждают высокую эффективность температурного биоуправления для педиатрических мигреней. Аналогичные подходы к определению эффективности других способов биоуправления пока неосуществимы ввиду ограниченности базы данных.

Головные боли напряжения. Здесь набор данных еще более ограничен. В упоминаемой работе [31] рассматривалось лишь небольшое число случаев лечения биоуправлением по ЭМГ головных болей напряжения, не включавших мигренозные симптомы. Bussone et al. [32] в своем исследовании использовали биоуправление по ЭМГ, сопровождавшееся релаксацией, и плацебо-метод. В обоих случаях наблюдалось выраженное снижение болей. Однако с течением времени состояние детей из группы биоуправления продолжало улучшаться, тогда как в группе плацебо этого не происходило. После 6 и 12 месяцев контроля улучшения в группе биоуправления статистически превышали результаты из группы плацебо (см. рис. 3). В других работах [33, 34] эффективность биоуправления по ЭМГ для эпизодических головных болей напряжения также подтверждалась. Однако нужны дальнейшие исследования, отделяющие воздействие биоуправления от релаксации.

Клинические аспекты. Обобщение результатов клинической практики показывает, что одни и те же процедуры в рамках биоуправления дают лучший эффект у детей и подростков по сравнению со взрослыми. Недавний количественный анализ около 60 случаев лечения биоуправлением по ЭМГ или температуре отдельно у детей и взрослых [35] подтвердил, что дети улучшают свое состояние более успешно по сравнению с взрослыми (см. рис.4). Возможно, одним из объяснений этого является более высокий показатель спонтанных ремиссий у детей, что нуждается в дальнейшем исследовании.

Собственный опыт [36] позволил выделить ряд преимуществ работы с пациентами младшего возраста, наряду с факторами, затрудняющими лечение (табл. 3). Green [37] разработала предписания и рекомендации для обучения навыкам саморегуляции детей в возрасте 7 лет и меньше. Туда входит, например, приглашение родителей на сеансы; выработка у ребенка отношения к терапевту как к «учителю биоуправления»; включение дополнительных техник в сеансы (диафрагмальное дыхание, визуализация).

Эффективность биоуправления может быть увеличена путем дальнейшего развития различных аспектов оценки и лечения. В работе Marcon, Labbe [39] обсуждаются когнитивные, саморегуляционные и психосоциальные факторы, влияющие на результаты лечения (языковые различия, восприятие времени, подходы к выполнению заданий). Особое внимание уделяется вопросам влияния окружения, в частности, членов семьи и учителей. В исследовании [40] дети и подростки с мигренью получали один из двух видов лечения: стандартное температурное биоуправление и биоуправление в сочетании с действиями их родителей, специально обученных контролировать поведение детей при головных болях (инструкции для родителей приведены в табл.4). Добавление этого аспекта к биоуправлению значительно улучшило клинические результаты лечения (снижение частоты головных болей, больший процент уменьшения клинических симптомов и др.)

Обсуждается набор факторов, которые могут являться пробными предикторами эффективности лечения [41-43]. В их числе: более экстернальное поведение, психосоматический дистресс, домашняя практика, неудачи в школе и дома и интенсивность головных болей; более младший возраст, хронический характер болей и подкрепление «болевого» поведения со стороны матери. Подчеркивается необходимость анализа этих предполагаемых факторов в различной обстановке и различными исследователями.

В последнее время среди аспектов биоуправления выделяется стоимость лечения и затрачиваемое на него время. В клинической практике встречаются достаточно сложные случаи, требующие более длительных курсов по сравнению с общепринятыми 8-12 сессиями. В связи с этим предлагается уменьшить контакты пациентов с врачом и проводить групповые занятия, что повышает требования к квалификации терапевта и качеству проводимых сеансов. Пилотные исследования лечения педиатрической мигрени [48] показали эффективность сеансов биоуправления, основанных на подробном инструктировании ребенка или его родителя для домашней работы.

Дальнейших исследований требуют вопросы соотношения поведенческих и фармакологических эффектов в процессе лечения, различные способы назначений, роль условий заболевания, а также условий, в которых проводится лечение.