Headache in Children: Update on Biobehavioral Treatments

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Abstract

Biobehavioral pain treatment consists of relaxation techniques, biofeedback treatment, operant pain treatment, pain coping, cognitive-behavioral treatment, and multimodal treatment. Especially in the treatment of pediatric headache, biobehavioral procedures have been found to be highly efficient and are widely accepted. They present similar effects as pharmaceutical treatments. In general, when standardized treatment programs are applied, the sessions are highly effective.

Keywords
- pediatric headache
- migraine
- behavioral treatment
- biofeedback
- cognitive therapy

Introduction

Rationales for Biobehavioral Pain Treatment

Pain is a subjective and unique experience that requires taking into account both psychological and physiologic components in diagnosis and treatment[1,2] Sensitization processes in both the peripheral and central nervous systems as well as learning mechanisms may contribute to maintaining pain in the absence of tissue damage. These sensitization processes are often modulated by excessive emotional load.[3] Moreover, experiences of uncontrollability may also trigger and maintain pain sensations. Anticipation of pain may trigger anxiety reactions, which in turn reinforce pain sensation. Uncontrollability is present when pain characteristics cannot be influenced by coping attempts. As a result, learned helplessness, physical and social inactivity, and depression occur. In addition, psychological comorbidities such as depression and anxiety may augment pain sensations.[4] These factors can be specifically and effectively targeted by biobehavioral treatment approaches. The aim of biobehavioral pain treatment is to modulate pain processing with the goal of achieving pain reduction. Therefore, biobehavioral treatment strategies focus on "unlearning" of pain and on modification of pain triggers and conditions that reinforce and maintain pain.

Treatment Options

Behavioral treatment strategies for pain management have been intensely developed in the last years. Most are derived from cognitive-behavioral therapy (CBT).[5] Meta-analyses prove high efficacy. In migraine treatment, behavioral treatment strategies have in many cases been shown to be as effective as pharmacologic treatment.[6,7] Using migraine and tension-type headache as examples, important biobehavioral treatment strategies for headache in children as recommended by national and international consensus guidelines are introduced and discussed below (►**Table 1**).

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Counseling and Guidance

Both medical and nonmedical treatment requires counseling and guidance of the child and its peer group. Importantly, a behaviorally oriented biopychosocial model of pain should be provided as proposed by Denecke and Kröner-Herwig.[4] Additionally, a headache diary should be introduced. Recording a diary itself reduces headache frequency.[8] The amount of analgesic intake should especially be recorded to exclude medication overuse for headache, which may also occur in children.[9] Recording daily activities, patterns of sleep, and workload in school is useful to estimate stress load and the relation between work and leisure time.[10,11] If significant medication overuse or dysfunctional activity patterns are found, escalation of biobehavioral therapy according to ►**Table 1** should be considered.

Relaxation Techniques

Relaxation techniques, especially progressive muscle relaxation and autogenic training, are cheap and easy to administer. The effectiveness of both relaxation strategies has been proven in several studies and meta-analyses[12–15]; their effect may be specific to the underlying headache[16] and unspecific in reducing anxiety. Despite many studies the specific underlying neurophysiologic effect remains unclear. Habituation to repetitive stimulation is typically reduced in migraine patients interictally, because it can be shown in the contingent negative variation paradigm, and one possible action of relaxation is to increase habituation toward normal values.[17,18] Relaxation may also reduce cortical arousal and excitability.[19,20] This may result in reduced information processing of pain-modulating subcortical areas.[21,22] However, these possible neurophysiologic mechanisms have not yet been proven.

Muscle relaxation training is applied as described by Bernstein and Borkovec,[23] including stepwise straining and relaxing different muscle groups. It is important to perceive the difference between these conditions. For children, especially in treating headaches, many different relaxation instructions exist, depending on the age group. Therefore, it is important to adapt the instructions to the age of the young patients.[24–26]

Table 1 Psychological pain therapy (overview)

Procedure	Description
Counseling and guidance of the child	Low-level coaching to change habits
Relaxation techniques	Progressive muscle relaxation
	Autogenic training
Biofeedback	Feedback of a physiologic function
Operant pain treatment	Learning to cope with pain-triggering situations, with attention on the importance of environmental factors in understanding pain mechanisms
Pain-coping strategies	Learning active pain modification in daily life
Cognitive-behavioral treatment	Modifying unfavorable habits, thoughts, and attitudes Patient learns to cope with pain more effectively

Biofeedback

The concept of biofeedback means the direct sensory feedback of a normally unconscious physiologic function (e.g., skin resistance, blood pressure, etc.). The aim of biofeedback treatment is to learn to actively change the targeted physiologic function into a desired direction, for example, to learn reducing the activation level. To achieve this goal, the physiologic function has to be fed back visually or acoustically so it can be perceived consciously by the subject.[27] Biofeedback as a therapeutic practice derives from behavioral therapy and can be used in the context of behavioral interventions to increase autoregulatory competence. Therefore, the effect of successful biofeedback training is similar to cognitive restructuring.[28] Biofeedback has proved to be successful in nonpharmacologic treatment of pain. According to recent meta-analyses, evidence levels for the effect of biofeedback in the treatment of migraine or tension-type headache are high.[29–31] Feedback parameters successfully used in headache treatment include electromyographic activity, electromyographic biofeedback,[30] blood flow (vasoconstriction training), skin conductance, and skin temperature.[32] Meta-analyses evaluate biofeedback as highly efficient and comparable with pharmacologic prophylaxis.[13,33,34] In summary, biofeedback training is highly effective.[27] Biofeedback treatment in children is highly efficient when skin temperature biofeedback or electromyographic biofeedback is applied.[32]

Operant Pain Treatment

Operant pain therapy derives from operant learning, in the context of pain therapy first described by Fordyce (for a review see[35]). Operant pain therapy focuses attention on the importance of environmental factors in understanding and treating pain mechanisms. Suffering may be especially distinct from pain and may be triggered by anticipation of threat to one's self or identity.[36] Patients learn to deal with pain instrumentally or via operant conditioning. For example, they learn to approach potentially pain-triggering situations instead of avoiding them.[37]

Operant pain treatment focuses on the following:

Increasing activity level. Increasing the activity level often reduces pain sensations. In a recent study aerobic exercise reduced headache and migraine.[38]

Reducing medication. It is known that increased intake of medication reinforces pain behavior and may often lead to increased pain sensations. Therefore, reducing medication works also as a conditioning paradigm for reducing pain.[9]

Reducing avoidance behavior. Avoidance behavior often occurs when migraine triggers are present. Patients learn to avoid these triggers not to provoke the next migraine attack. Comparable with therapy of anxiety, the avoidance of triggers may enhance these symptoms and may lead to more headaches as described by Martin.[37]

Changing reinforcing contingencies of the environment. Often, the environment reacts with reinforcing consequences

when the patient reports on his or her headaches. Therefore, the environment (parents, teachers) should be informed that they should ignore pain expressions and should reinforce activity behavior and engagement in pain-incompatible situations.[35,36]

Pain-Coping Strategies

Training in pain coping builds on relaxation techniques and extends them behaviorally. The aim of pain-coping training is to learn active pain modification in daily life. Described by Turk and Rudy,[39] pain-coping training focuses on self-care, especially in pain-suffering conditions. Pain-coping strategies may target both affective (distress, depression) and cognitive (beliefs, appraisals, expectations) factors. Negative beliefs act indirectly on pain and disability by reducing physical activity and consequently reducing muscle flexibility, strength, tone, and endurance. Fear of reinjury and fear of loss of disability compensation can also influence the extent of patients' disability. One's beliefs about the effectiveness of coping skills and about whether the patient can execute such skills ("self-efficacy beliefs") are essential in adaptive coping with pain. It has been suggested that individuals' choice of action and the amount of effort to be spent on the action are largely determined by the self-efficacy beliefs. Chronic pain patients often believe pain is uncontrollable. Such beliefs appear to directly impact functioning and mood as well as influence patients' willingness to engage in coping efforts.[40] Pain-coping training programs consist of education, exercise, and transfer into daily life.

In the *education* part, patients are informed about neuronal, biochemical, and psychological pain mechanisms, including the diathesis pain model, biopsychosocial models, and the gate-control theory. Presentation of these models has to be adapted according to age in children.[4]

During *exercise* the patient learns to relax systematically and to modify attentional functions. Using imagination and cognitive restructuring techniques, the patient learns to focus attention on pain-reducing actions instead of pain-amplifying thoughts.[41]

During *transfer* these techniques have to be integrated into daily life, especially into school situations.

Cognitive-Behavioral Treatment

CBT aims at modifying unfavorable habits, thoughts, and attitudes. The patient learns to cope with his or her pain more effectively.[42] The cognitive-behavioral approach enables the patient to come in contact with the symptoms of the pain, especially with negative affects like anxiety and depression.[4,43,44] CBT is helpful when the patient is highly achievement oriented. The patient learns to improve body perception during work and gets to know the correlation between thoughts and body reactions. During CBT strategies are used that modify thoughts and unfavorable habits. Additionally, comorbidities are treated; especially in headache in children, emotional wellness has a great priority.[45] CBT aims at the prevention of headache episodes and the modification of cognitive-emotional and cognitive-behavioral processes that influence pain.[15]

Multimodal Treatment

Often, the above-listed treatments can be compiled into treatment programs for individuals or groups. Especially in children some programs exist that are evaluated and applied to defined groups. Whereas Migraine Patient Seminar[46] or Mercy Migraine Management Program[47] focus on education in a primary care setting, other treatment programs focus on psychological interventions based on CBT.[30,48] For all these treatment programs, manuals exist that describe the sessions in detail.[4,15,49,50]

Efficacy of Biobehavioral Pain Treatment

In many meta-analyses, efficacy of treatment in children has been proven using standardized effect sizes for controlled trials and pre- and postequivalents for uncontrolled studies.[13,51,52] As a global measure of efficacy, "days with migraine" are often used.[53] Group treatment seems to produce a better effect than single treatment.[54] Based on 23 studies in their meta-analysis, Trautmann et al[30] concluded that relaxation, biofeedback, and CBT are highly effective using headache symptom variables (frequency, intensity, and duration of headache or a comprehensive headache index), medication, and clinically significant change (reduction of headache symptoms $\geq$ 50% based on the headache index or any of the above-mentioned variables) as efficacy measures.

Generally, it could be demonstrated that CBT is more effective than nontreatment (waiting group) or sham treatment. Overall, as the primary endpoint of efficacy, headache frequency or headache duration was used. Relaxation or biofeedback alone obtain improvement in about 50%; when combined about 60% improvement was seen. With CBT and biofeedback, efficacy in children with migraine reaches 75%.[55]

Summary

CBT for children with headache is effective both in the short and long term. Especially when standardized treatment programs are used, group sessions are highly effective in terms of headache frequency, headache duration, or headache intensity.

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