

Comprehensive Summaries of Uppsala Dissertations
from the Faculty of Social Sciences 119



Recurrent Headache among Swedish Adolescents

*Psychosocial Factors, Coping and Effects of Relaxation
Treatment*

BY

ÅSA FICHTEL



ACTA UNIVERSITATIS UPSALIENSIS
UPPSALA 2003

TABLE OF CONTENTS

INTRODUCTION.....	9
HISTORY.....	9
CLASSIFICATION.....	11
PREVALENCE.....	13
PROGNOSIS.....	14
<i>Short-term prognosis</i>	14
<i>Long-term prognosis</i>	15
ETIOLOGY.....	16
PSYCHOLOGICAL SYMPTOMS.....	17
PSYCHOSOCIAL FACTORS CORRELATED TO HEADACHE.....	18
TRIGGER FACTORS.....	19
TREATMENT.....	20
<i>Drug treatment</i>	20
<i>Relaxation treatment</i>	21
<i>Relaxation treatment and headache activity</i>	22
COPING.....	25
<i>Coping as style or process</i>	25
<i>Coping responses</i>	26
<i>Adaptive and maladaptive coping strategies</i>	27
<i>Developmental aspects of coping</i>	27
<i>Coping and recurrent headache</i>	28
<i>Conceptualisation of the influence of stress and coping among headache sufferers</i>	29
<i>Pain Coping Questionnaire, PCQ</i>	30
AIMS.....	32
METHOD.....	33
DESIGNS AND SUBJECTS.....	33
<i>Studies I and II</i>	33
<i>Study III</i>	34
<i>Study IV</i>	34
PROCEDURES.....	36
<i>Studies I and II</i>	36
<i>Study III</i>	37
<i>Study IV</i>	38
APPLIED RELAXATION.....	38
RELAXATION WITH VISUALIZATION.....	39
ASSESSMENT INSTRUMENTS.....	39
<i>Frequency and severity of pain (Studies I and II)</i>	40
<i>The Pain Coping Questionnaire (PCQ) (Studies II and IV)</i>	40
<i>Efficacy of pain coping strategies (Study II)</i>	41
<i>Center of Epidemiologic Studies: Depression Child (CES-DC) (Studies I and II)</i>	41
<i>Revised Child Manifest Anxiety Scale (RCMAS) (Studies I and II)</i>	42
<i>The Functional Disability Inventory (FDI) (Studies I, III and IV)</i>	42
<i>Illness Behavior Encouragement Scale (IBES) (Studies I, II and IV)</i>	42
<i>Medication usage, school absence and leave (Studies I and II)</i>	43
<i>Headache activity (Studies III and IV)</i>	43
<i>Study</i>	45
STATISTICAL METHODS.....	45
<i>Study I</i>	45
<i>Study II</i>	45
<i>Study III</i>	46
<i>Study IV</i>	46

ETHICAL CONSIDERATIONS	47
RESULTS AND METHODOLOGICAL CONSIDERATIONS.....	47
SUMMARIES OF STUDIES I-IV	47
<i>Study I: Psychosocial impact of headache and comorbidity with other pains among Swedish school adolescents.....</i>	<i>47</i>
<i>Study II: Pain coping strategies among Swedish adolescents as measured by the Pain Coping Questionnaire.....</i>	<i>49</i>
<i>Study III: Does relaxation treatment have differential effects on migraine and tension-type headache in adolescents?</i>	<i>52</i>
<i>Study IV: Relaxation treatment administered by school nurses to adolescents with recurrent headaches Methodological considerations.....</i>	<i>53</i> <i>54</i>
<i>Conclusions and clinical implications</i>	<i>57</i>
DISCUSSION	59
GENERAL DISCUSSION	59
FUTURE IMPLICATIONS AND DIRECTIONS.....	67
ACKNOWLEDGEMENT.....	69
REFERENCES.....	71

INTRODUCTION

Recurrent headache among children and adolescents is one of the most common health problems throughout the world (Martin-Herz, Smith, & McMahon, 1999). In a large study performed by the World Health Organization (WHO) in 28 countries of 11-15 year-old school children's health, headache was found to be a very common health problem and the most prevalent pain complaint (Marklund, 1997). Adolescents in Sweden reported a high prevalence of frequent headaches as compared to most other countries. Other commonly reported pain problems were abdominal pain and back pain (Marklund, 1997), more common among girls than boys. Somatic symptoms like limb pain and aching muscles have also been reported as common pain complaints (Campo & Fritsch, 1994). Combinations of such pains have also been reported (Perquin, 2000). Approximately 200,000 children and adolescents in Sweden are estimated to suffer from migraine (Dahlöf, 2001a) and an even higher number suffer from tension-type headaches (Bille & Larsson, 1998a). Living with recurrent pain can be debilitating and may lead to negative psychosocial impact and negative consequences in daily life for the individual (Carlsson, Larsson, & Mark, 1996; Hunfeld et al., 2001) as well as for their families (McGrath, 2001). Even though recurrent headache is the most common pain complaint among adolescents, few treatment options are available and such problems are likely to be undertreated in these age groups.

History

The word migraine stems from the Greek word hemicrania (half skull) and the Greeks considered evil spirits to be the origin of headache. About 7,000 years before Christ, symptoms of migraine were treated by trepanation. Thus a 20-cm long stone chisel was used to penetrate the skull bone to relieve the pain. One can assume that at least half of the patients

got relief from pain, they simply died after such a procedure. Hippocrates, “the father of medicine,” (460-370 BC) was interested in migraine. In his work *Obiter dicta*, there are several descriptions of symptoms associated with and preceding headache.

An early physician in the headache area was Edvard Liveing (1832-1919), who wrote one of the first works on headache “On Megrin, Sick-Headache and some allied disorders: A contribution to the Pathology of Nervestorms”. This was also the first publication in which it was noticed that migraine was more common among women than men.

During the same century, William Gowers (1845-1919) published his book “The borderline of epilepsy” in which he describes migraine as a disease and points out the importance of having a healthy life-style. Among several treatments, he suggested the use of nitroglycerin and Indian hemp (Marijuana) (Dahlöf, 2001b).

Even though descriptions of children and adolescents with headache were available as early as in the 16th century, headaches among children have not been a prime interest among researchers until the middle of the 20th century (Bille, 1962a). In his book “Essays on Diseases on children” (1873), a British pediatrician, William Henry Day noted that nonorganic headaches were very common in childhood and reported that “Headaches in the young are for the most part due to bad arrangements in their lives” (Rothner, 2001). Bo Vahlquist (1955) presented the first epidemiological study of migraine in school children in Uppsala. At this time, Bo Bille, a pediatrician also started a subsequent and extended longitudinal study in the same city in which the prevalence, characteristics and prognosis of migraine and nonmigrainous headaches were investigated among more than 9,000 school-children 7-15 years of age (Bille, 1962a). A subgroup of subjects with pronounced migraine was followed for 40 years (Bille, 1997).

Classification

Since 1988, headaches are classified according to the International Headache Society (IHS) classification criteria and more than 100 different types have been described (International Headache Society, 1988). According to the IHS, headaches are divided into primary and secondary headache. Primary headaches do not have an underlying disease and the most common types are migraine, tension-type and cluster headaches. Underlying causes of secondary headaches are organic disorders or physical diseases. In such cases headache is part of a syndrome. If the underlying disease is cured the headache often disappears. Such symptoms can be caused, for example, by diseases in the brain such as tumours, poisoning or infections (Bille & Larsson, 1998b). The criteria for the two primary types is depicted in Tables 1 and 2 and localization of the respective headache types in Figure 1.

Table 1. The IHS criteria for migraine without aura.

Migraine without aura (1.1)

- A. At least 5 attacks fulfilling B-D.
- B. Headache episodes lasting 2-48 hours (untreated or unsuccessfully treated). For adults the duration is 4-72 hours
- C. At least two of the following characteristics:
 - Unilateral location
 - Pulsating quality
 - Moderate to severe intensity (inhibits or prohibits daily activities)
 - Aggravated by walking up stairs or similar routine activity
- D. During headache attack at least one of the following symptoms:
 - Nausea/vomiting
 - Photo/phonophobia

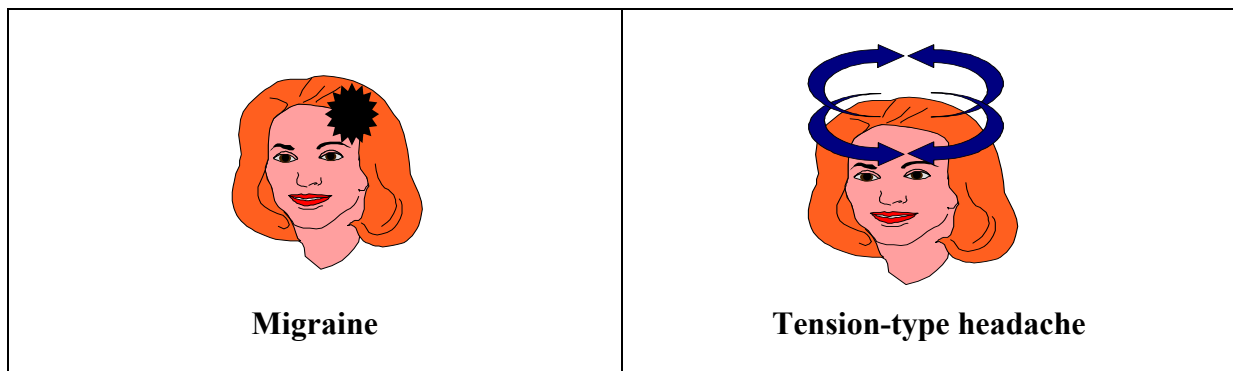
Migraine with aura (1.2) is characterized by visual disturbances, such as blurring, spots of flashes, sometimes moving over the visual field in a zigzag pattern, paraesthesiae or feelings of numbness.

Table 2. The IHS Criteria for episodic tension-type headaches.

Episodic tension-type headache (2.1)

- At least 10 previous headache episodes fulfilling criteria B-D. Number of days with such headache is less than 180 days a year (15 days a month)
- B. Headache duration lasting from 30 minutes to 7 days.
- C. At least two of the following pain characteristics:
1. Pressing, tightening (non-pulsating) quality
 2. Mild or moderate intensity (can induce but does not necessarily lead to avoidance of activities)
 3. Bilateral or varying location
 4. No worsening of physical activity
- D. Associated symptoms (nausea, vomiting, photo/phonophobia) are absent or mild (or presence of one of these)

Figure1. Common localization of migraine and tension-type headaches.



Chronic tension-type headache (2.2)

All of the symptoms described above for tension-type headaches and in addition a frequency of at least 180 days a year or 15 days a month for a period of at least six months, are required for establishing a diagnosis of chronic tension-type headache.

Prevalence

Sifo research and consulting (SIFO, 1998) conducted a telephone survey in which 1,000 persons 15 years of age and older were asked about their headaches during the preceding year. Seventeen percent of women and eight percent of men reported that they had migraine, hence the sex ratio was about 1/2.

Among school children, the prevalence rates for migraine vary between 3 and 19% (Abu-Arefeh & Russell, 1994; Bille, 1962b; Raieli, Raimondo, Cammalleri, & Camarda, 1995; Sillanpää, 1983a, 1983b; Stang & Osterhaus, 1993). Recurrent headache occurring at least once a month has a prevalence rate between 23% and 51% among school children (Kristjansdottir & Wahlberg, 1993; Sillanpää, 1983a, 1983b). Frequent headaches occurring once a week or more have been reported by 7-44% of school-aged children (Bandell-Hoekstra et al., 2001; Brattberg & Wickman, 1991; King & Sharpley, 1990; Kristjansdottir & Wahlberg, 1993; Marklund, 1997). Chronic daily headaches (more than 15 days a month) are reported by 0.2-2.5% of children and adolescents (Abu-Arefeh & Russell, 1994; Newacheck & Taylor, 1992; Sillanpää, Piekkala, & Kero, 1991). The prevalence rates for tension-type headache have recently been found to be approximately 10% among 7-16 year-old Swedish children (Laurell, Eeg-Olofson, & Larsson, 1999) and Bille (1962a) reported similar prevalence figures for frequent non-migrainous headaches. A few studies have shown an increased prevalence for migrainous as well as other headaches (Bandell-Hoekstra et al., 2001; Marklund, 1997; Sillanpää & Antilla, 1996).

The differences in prevalence figures for the various headache types may depend partly on differences in assessment methods used. A child or an adolescent can also suffer from more than one headache type and may have difficulties differentiating between the types (Metsähonkala, 2002), this is true particularly for younger children. For example, according to interviews, the proportion of children suffering from mixed headache has been reported to be 10%. However, using a diary, the estimates for combined headache were much higher (Metsähonkala, Sillanpää & Tuominen, 1997a). For example, about eight out of ten children reported other headache than migraine in diary recordings as compared to interview information (Metsähonkala et al., 1997a).

Prognosis

Short-term prognosis

The short-time prognosis of migrainous headache among children and adolescents is not very favorable. For example, in a study of 8-9 year-old children with migraine, Metsähonkala and co-workers found that about 80% still had migraine at 11-12 years of age (Metsähonkala et al., 1997b). The short-time prognosis for recurrent nonmigrainous headaches seems to be somewhat better than for children with migraine (Larsson, 2002). For example, Brattberg and Wickman (Brattberg & Wickman, 1993) reassessed almost 500 school children (11 and 14 years of age) after two years. At the retest, 14% of those who had a headache at the first assessment were free of headache. Around 30% reported headache on both occasions, girls more often than boys (Brattberg & Wickman, 1993). In another school-based study Wännman (1987) noted that 11% of 16-17 year old adolescents reported recurrent headache and about half of them still had such headaches a year later. In conclusion, the short-term prognosis seems to be better for those with tension-type headache than for those suffering from migraine (Larsson & Zahlua, 2002).

Long-term prognosis

The long-term prognosis of childhood migraine has been most thoroughly explored by Bille (Bille, 1997) in his longitudinal studies. At a six-year follow-up, 34% had had no migraine for at least one year. At the 16-year follow-up, data showed that 62% of the migraine group had been migraine-free for at least 2 years during puberty or as young adults. However, when growing older, 22% of the migraine children had relapsed. At a 22-year follow-up, 40% were migraine-free and ten years later (ages 37-43 years), slightly more than half of the sample still had migraine. In a 40-year follow-up, at least 23% had been migraine-free since puberty, the boys more often than the girls. Twenty-nine percent had suffered from migraine at least once a year during all 40 years, while 22% still had migraine but had been free of migraine for 2 years or longer (average 10 years). In conclusion, about half of the subjects were migraine-free at the 40-year follow-up. In another study, it was found that 40% of the migraine children followed for more than 5 years had been symptom-free for more than a year (Hernandez-Latorre & Roig, 2000). Also, children with headache onset before six years of age had a four times higher risk of a less favorable course than those with headaches starting between 6 and 10 years of age.

Even though the long-term prognosis of tension-type headache has not been extensively examined, it seems to be better than for migraine headache. For example, in the study by Bille (Bille, 1962b), about two thirds of the subjects with nonmigrainous headaches were headache-free at a six-year follow-up evaluation. In another study of children starting school (Metsähonkala et al., 1997b), about half of the children with nonmigrainous headaches still had headaches 3-4 years later, and one third had turned into migraine sufferers.

Etiology

The mechanisms accounting for migraine and tension-type headache are not fully understood. During many years, the vascular theory was the main physiological “state of the art theory” for migraine. According to this theory, a constriction of the intra- and extracranial arteries followed by a dilation caused the pain (Wolff, 1955). Today, more complex models involving central as well as peripheral mechanisms have been suggested (Dahlöf, 2001b).

According to such theories migraine attacks may start in the CNS as a response to stress and emotions or in the thalamus as a response to stimuli or to an “inner” biological clock (Lance & Goadsby, 1998). The brain in itself is insensitive to pain while the membranes and blood vessels in and outside the brain are sensitive to pain (Goadsby, Haregreaves, & Cutrer, 1997). Nerve signals stimulate the release of several neurotransmitter substances such as serotonin (5-HT, 5-Hydroxytryptamin) which in its turn releases nitrogen oxide in the blood vessels of the membrane. Nitrogen oxide stimulates sensory and peripheral nerves and causes intense pain (Goadsby et al., 1997). Further, serotonin influences the centre for emotions in the brain (limbic system), but also the cortex where cognitive and sensory processing occurs. An imbalance of the serotonin receptors is supposed to be involved in a migraine attack (Dahlöf, 2001b). Neuropeptides such as CGRP (Calcitonine Gene Related Peptide) and Substance P are also supposed to play an important role for migraine pain. CGRP is a substance that forcefully dilates the blood vessels and substance P increases the permeability of the blood vessels. These activities together increase the sensitivity of the brain and the surrounding tissues (Dahlöf, 2001b).

The theories about mechanisms for tension-type headaches are relatively new and have not been investigated to the same extent as migraine headache. For a number of years, tension-

type headache was considered to have primarily psychological origin (Jensen, 2001). However, traditional etiological theories have postulated increased muscle tension as an important mechanism. Recently, empirical support for such mechanisms have been found in studies of adults (Jensen, 2001; Silberstein, Lipton, & Dalessio, 2001). Peripheral mechanisms have been suggested to play an important role in episodic tension-type headaches, while central mechanisms are supposed to be more involved in chronic tension-type headaches. However, the importance of such mechanisms may differ between persons and periods (Jensen, 2001; Silberstein et al., 2001).

A higher sensitivity to mechanical pressure has been found among subjects with chronic tension-type headache. This depends on a sensitization of the peripheral sensory receptors because of prolonged sensory input from the muscles in the face and neck regions (Bendtsen, 2000). The primary cause of the development of tension-type headache is supposed to be located in the peripheral nervous system (Jensen, 2001).

Psychological symptoms

In several studies, a higher prevalence has been reported of psychological symptoms among children and adolescents with recurrent headaches than among headache-free controls. In the first large epidemiological study, Bille (1962) found that children with migraine were more anxious, tense and nervous than those without migraine. Individuals with recurrent headaches have been found to experience stress, anxiety, depression and other somatic symptoms more often than those with no or infrequent headaches (Andrasik et al., 1988; Carlsson et al., 1996; Langefeld, Koot, Loonen, Hazebroek, & Passchier, 1996; Larsson, 1988; Martin-Herz et al., 1999). In a recent study (Hunfeld et al., 2001), adolescents with recurrent headaches reported the poorest quality of life even though they had less frequent pain than subjects with other

types of pain. Martin-Herz and collaborators (1999) found that subjects with more frequent headache had more anxiety and depressive symptoms as well as more disability than did subjects with no or infrequent headache. In most of the studies of psychological symptoms, subjects with headache were first recruited and then screened for psychological symptoms. In a longitudinal epidemiological study (Egger, Angold, & Costello, 1998), the subjects were first screened for depressive and anxiety disorders and then assessed for headache symptoms. Girls with depressive and anxiety disorders were found to have significantly more headache than girls without such problems. For boys with those disorders, there was no such relationship. On the other hand, headache was more common among boys with conduct disorders (Egger et al., 1998). Although the majority of studies report more psychological symptoms among headache sufferers, it should be noted that a few studies have shown inconsistent results in that no differences between headache sufferers and matched subjects without headache for anxiety and depression were reported (Cooper, Bawden, Camfield, & Camfield, 1987; Kowal & Pritchard, 1990). However, in these later studies subjects with more anxiety also had more severe headache.

Psychosocial factors correlated to headache

Besides higher levels of psychological symptoms, negative impact has been demonstrated on other psychosocial areas among subjects with recurrent headaches. In this thesis psychosocial factors are defined as school absence, number of friends and disability in daily life. In a study of a school sample, Martin-Herz and collaborators (1999) found that those with frequent headaches had lower levels of physical functioning, more interference with daily activities as well as more school days missed in the past six months compared to subjects with infrequent headache. In a large clinical study, Karwautz and co-workers (1999) found that subjects with migraine were absent from school significantly more often than those with tension-type

headache or healthy control subjects. In the same study, it was also found that subjects with tension-type headache had fewer friends than did subjects with migraine. Similarly, Abu-Arefeh and Russel (1994) found that migraine subjects were absent from school more often due to headache as well as other illnesses than were controls. Carlsson and co-workers (1996) reported that subjects with migraine or migraine coexisting with tension-type headache were absent from school more often due to illness compared to subjects with tension-type headache only. Adolescents with headaches have also been found to be absent from school more often due to other somatic complaints compared to headache-free controls (Larsson & Melin, 1988a). In conclusion, adolescents with more frequent or intense headaches seem to be more affected than subjects with low frequency and intensity of their headache.

In a recent study, 42 adolescents with various persistent pains were assessed on three occasions during three years (Hunfeld et al., 2002). The authors noted that the functional status of the adolescents was relatively poor but stable over the assessment period.

Adolescents with headache withdrew to a higher degree from social activities than did those with other types of pains such as abdominal, back and limb pain.

Trigger factors

In view of the research cited so far it is concluded that there are complex mechanisms of biological, psychological as well as social origin involved in both migraine and tension-type headache. A variety of biological and psychosocial factors also play an important role in triggering headaches in children and adolescents. Biological factors such as an allergic problem or psychological triggers such as various stressors, may both elicit headaches. Emotional and psychological factors such as stress in daily life or due to school work have been found to be the most common triggers of headache complaints among school-aged

children (Bener et al., 2000; Bille, 1962b; Egermark-Eriksson, 1982; Lee & Olness, 1997; Passchier & Orlebeke, 1985). Other commonly reported triggers such as lack of sleep (Passchier & Orlebeke, 1985) or insomnia (Rhee, 2000), noise at school (Egermark-Eriksson, 1982) have also been reported. Emotional upset was reported to be the most common trigger factor for migraine among children and adolescents (Marates & Wilkinson, 1982). Hardly any empirical evidence exists in the literature of the role of other triggers such as certain foods or weather conditions even though such factors are often cited as common causes of headache (McGrath & Hillier, 2001). Patricia McGrath (2001) has proposed a conceptual model concerning the diversity of stress factors. This explanation of the influence of stress factors on headache does not focus on the exposure to the stress in itself. Rather, the suggestion is that the individual's reaction to the stressor and the subsequent coping strategy used, may differ between those suffering headache complaints and individuals not having headaches (McGrath & Hillier, 2001).

Treatment

Drug treatment

Drug regimes for children and adolescents with recurrent migraine consist mainly of two types, abortive and prophylactic medication. The aim of abortive drug treatment is to relieve the pain symptoms connected with an acute attack, while preventive medication is aimed primarily at decreasing the frequency of attacks (Cherchi & Zompto, 2001). Salicylates, acetaminophen or paracetamol as well as Non Steroid Anti Inflammatory Drugs (NSAID) are examples of abortive drug treatment (Bille, 1998). Due to the risk of Reyes syndrome, the use of salicylates (aspirin) is not recommended for children under the age of 12 (Cherchi & Zompto, 2001). Reyes syndrome is a severe and sometimes fatal disease causing serious liver damage and CNS symptoms. Even though the cause remains unknown a link between salicylates and Reyes syndrome has been found (Olsson & Jylli, 2001). Thus the treatment of

choice is the use of mild over-the counter analgesics such as acetaminophen (paracetamol) (Pakalnis, 2001) or NSAID drugs (Hämäläinen, Hoppu, Valkeila, & Santavuori, 1997)

Triptans (i.e Sumatriptan) as an abortive medication for children and adolescents with migraine have not shown similar positive effects as for adults (Hämäläinen, Hoppu, & Santavuori, 1997; Winner et al., 2001). In a recent study 32% of adolescents reported that they were pain-free 2 hours after being treated with 5 mg oral triptans as compared to 28% of those receiving placebo (Winner et al., 2001). Overall, the adolescents had a good tolerability for this medication.

Prophylactic treatment of migraine is recommended if the attacks are very frequent (at least once a week or more often) and has a major influence, on for example, children's school attendance (Pakalnis, 2001). The most commonly used drugs are Beta-blockers (i.e Propranolol). The results of a few controlled studies in this field have yielded inconsistent results (Hermann, Kim, & Blanchard, 1995). For recurrent tension-type headaches, mild over-the counter medications such as paracetamol or NSAID are often the treatment of choice (Bille, 1998; Dahlöf, 2001a).

Relaxation treatment

In the beginning of the 20th century, progressive relaxation was developed by Edmund Jacobson (Jacobson, 1929) who found that different states of heightened tension could be counteracted by a relaxed state. Originally, progressive relaxation was a very strenuous treatment involving up to two hundred sessions. In the 1960s and 70s, briefer forms of relaxation were developed for adults (Bernstein & Borkovec, 1973; Wolpe & Lazarus, 1966) and later also adapted for children (Cautela & Broden, 1978). Relaxation training for children

was developed to teach them a way to cope with various types of stressful or anxiety provoking situations (Forman, 1993), but also to induce a physiological change. Relaxation training can be seen both as a preventive and a palliative treatment for headache. As a coping technique for headache it has two functions. First, relaxation distracts from the thoughts about a painful headache. Second, physiologically, relaxation causes vasodilation and a reduced heart rate incompatible with tension. Research on children and adolescents with recurrent headaches has shown relaxation treatment to be one of the most powerful treatments alternatives to prophylactic medication (Hermann et al., 1995).

Relaxation treatment and headache activity

For adults with recurrent headache, relaxation has proven effective for those with tension-type headache (Gauthier, Ivers, & Carrier, 1996). For those with migraine, a similar but weaker pattern of positive results has been found but some studies have shown a disparate outcome (Gauthier et al., 1996). Relaxation has been found to effectively reduce migraine or tension-type headaches in children and adolescents. For example, a recent review found clear evidence for relatively simple treatments such as relaxation to be effective for children and adolescents suffering from recurrent headache (Eccleston, Morley, Williams, Yorke, & Mastroiannopoulou, 2002). The odds ratio for achieving a 50% reduction of headaches with relaxation training was 9 times higher than without such treatment. Similar conclusions have been reached in another recent review (Holden, Deichmann, & Levy, 1999). In clinic-based studies, relaxation or combinations of relaxation and biofeedback approaches have been found to be superior to placebo (Richter et al., 1986) or a waiting list control condition for migraine headache (Fentress, Masek, & Mehegan, 1986). Olness and collaborators (Olness, Mac Donald, & Uden, 1987) examined the effects of relaxation in comparison with the effects of a beta-blocker (propranolol) and found that relaxation treatment was superior in improving

migraine headache. However, one study including a large sample of children and adolescents found no differences between relaxation and a non-specific form of therapy compared with a single session treatment on children's migraine activity (McGrath et al., 1988).

In nonclinical, individual or group-based studies of tension-type headache as well as migraine, relaxation was superior to self-monitoring of headaches using a diary (Larsson, Daleflod, Håkansson, & Melin, 1987; Larsson & Melin, 1988a; Larsson, Melin, & Döberl, 1990). Similar effectiveness of therapist-assisted and self-help programs have also been demonstrated (Larsson et al., 1987). In a mainly home-based, self-help treatment study, it was found that home-based training was as effective as therapist training, but more cost-effective (Larsson et al., 1987). However, in a subsequent study, Larsson et al. (1990) compared a self-help relaxation approach to a waiting-list control condition and a muscle relaxant drug, and found significant effects in favor of relaxation training. However, only 19% of the students attained a clinically relevant improvement level and the outcome was significantly poorer than in the previous study (Larsson et al., 1987). In conclusion, a lower degree of headache improvement seems to be accomplished in that a higher number of subjects attain clinical improvements in studies with a therapist compared to self-help approaches (Larsson, 1999).

In several of the school-based studies, therapists have consisted of graduate students in psychology with relatively limited experience of treatment and headaches among adolescents (Larsson et al., 1987; Larsson & Melin, 1986). In a study in which three school-nurses administered relaxation training in small groups at school, a positive outcome was found on headache among those treated with relaxation (Larsson & Carlsson, 1996).

Another effective treatment for recurrent headaches is the use of various biofeedback procedures. Biofeedback can be seen as a form of relaxation supported by physiological

devices and data to enhance the individual's learning of necessary skills. There are different types of feedback. Thermal feedback is a method with an aim to increase the peripheral temperature in the hands. Electromyographic (EMG) biofeedback is another method with an aim to reduce muscle tension of the head. The main aim of both relaxation and biofeedback approaches is to reduce physiological arousal associated with stress and headache, both containing the same components (for example, diaphragmatic breathing and mental imagery) (Andrasik, Larsson, & Grazi, 2002). In a few studies, the mechanism has been investigated that moderates improvement among tension-type headache by biofeedback (Andrasik & Holroyd, 1983; Holroyd et al., 1984; Rokicki et al., 1997). Cognitive, rather than physiological mechanisms were found to influence the outcome of such treatment. For example, Rokicki and collaborators (1997) found no relation between either EMG activity or central pain modulation and outcome of treatment. On the other hand, cognitive mechanisms such as the individuals' belief of their own capability to control headache (self-efficacy) were related to outcome of treatment. The authors concluded that the cognitive components rather than changes in EMG activity were influenced by the biofeedback. These components apparently work as mediators of headache improvement.

In a meta-analysis of outcomes of behavioral and drug treatments for pediatric migraine, Hermann and collaborators (Hermann et al., 1995) noted that thermal biofeedback and interventions combining thermal biofeedback and relaxation were the most effective as compared to other behavioral approaches, psychological and drug placebo. Relaxation and biofeedback approaches were also superior to the more commonly used prophylactic drugs. However, the authors emphasized that caution should be exercised when interpreting the results, since several studies were excluded due to insufficient statistical information or methodological flaws. The need was also stressed for direct comparisons between behavioral

and pharmacological interventions to enable safer conclusions about differences in efficacy. Sartory and collaborators (1998) found in a more recently conducted study that relaxation and biofeedback combined with stressmanagement was superior to a prophylactic drug (metoprolol).

Coping

The different ways an individual handles a stressful or painful situation are often described as coping behaviors. The use of the term coping originates in the 1960s as a description of certain sets of adaptive defense mechanisms (Zeidner & Endler, 1996). Today, a common and frequently used definition of this concept is “the individual’s response to internal or external stressors appraised as taxing or exceeding his or her resources and endangering his or her well being” (Lazarus, 1993). Coping strategies have been found to be associated with functional and psychological adjustment among adults with disease-related pain (Gil, Wilson, & Edens, 1997) and chronic pain (Jensen, Turner, Romano, & Karoly, 1991).

Coping as style or process

In the conceptualization of coping two approaches have been distinguished (Lazarus, 1993), i.e. style and process approaches. The main focus of the style approach is on coping as a relatively stable individual disposition. The main interest is to identify consistent patterns in the ways an individual handles various stressors. The process approach is focused on how coping strategies change over time and situations. According to this notion the use of coping strategies depends on how the individual appraises the stressor and the outcome of previously employed strategies. Because such judgements are dynamic, coping strategies may change from time to time and also between situations within the same individual.

Some types of coping strategies seem to be more stable than others (Lazarus, 1993). For example, among adolescents with sickle-cell disease -a deficiency in the hemoglobin causing ischemic pains (Olsson & Jylli, 2001)- the use of active coping strategies was relatively stable over a nine-month period, while negative thinking or illness-focused strategies varied over time (Gil et al., 1993). When children, adolescents and adults with sickle-cell disease were examined during one and a half year, it was found that coping strategies among adolescents were the least stable over time as compared to both children and adults (Gil et al., 1997). Thus, in clinical practice and applied research a good way to measure coping strategies would be from both a style and process approach to find out more about stability in individuals and across situations.

Coping responses

There are various definitions of coping responses in the literature. Many theories emphasize some major functions of coping, either problem-focused versus emotion-focused coping, or behavioral versus cognitive coping (Gil et al., 1997; Lazarus, 1993). Problem-focused strategies aim at changing the problem by acting in the environment. Emotion-focused coping strategies aim at changing the individual's attention to the stressor or the relational meaning of what is happening (Lazarus, 1993). Behavioral coping strategies are overt behaviors a person uses to deal with stressors, while cognitive coping strategies are mental strategies or cognitions to deal with stress (Gil et al., 1997). None of the above mentioned coping strategies are intrinsically adaptive or maladaptive. Their adaptiveness must be evaluated independently of assessment of the use of each coping strategy.

Adaptive and maladaptive coping strategies

Some coping strategies such as active responses may reduce pain and its accompanying disability. For example, a Danish study of juvenile arthritis showed that higher levels of behavioral distraction strategies and positive self-statements were related to less present but also less reported everyday pain (Thastum, Zachariae, & Herlin, 1998). For adolescents with musculoskeletal pain, some strategies have been found to be more adaptive than others (Varni et al., 1996). Strategies directing attention away from pain were associated with less depression, while seeking social support and attempts to rest were associated with higher levels of depression. Seeking social support was also associated with higher levels of anxiety. Attempts to rest were positively associated with higher levels of present pain. In children with sickle-cell disease, coping strategies involving high levels of negative cognition and self-isolation were related to more pain and lower levels of activity and functioning (Gil, Williams, Thompson, & Kinney, 1991). Finding an adaptive way to cope with pain may help the child to achieve increased feelings of control, but may also lead to alterations in the expectations for pain (Palermo, 2000).

Developmental aspects of coping

The types of coping strategies used change from childhood to adolescence (Boekaerts, 1996; Galli & Guidetti, 2002). For example, younger children more often use behavioral or primary control strategies than do older children (Galli & Guidetti, 2002). As children mature, the use of emotion-focused, internal, cognitive and secondary coping increase (Boekaerts, 1996; Galli & Guidetti, 2002). Child age also correlates positively to the number of strategies and levels of avoidance strategies being used (Reid, Dubow, & Carey, 1995). A relatively well-developed self-control is a prerequisite for the use of avoidance strategies (i.e. cognitive distraction coping). This is probably related to the fact that abstract reasoning develops during

adolescence. The reason why behavioral coping strategies are used to a greater extent at younger ages may be that behavioral coping is more easily learnt through observation of models such as parents and friends. Cognitive coping strategies are more difficult to learn from models because such processes are internal.

Coping and recurrent headache

Only a limited number of studies focus on coping strategies that adolescents use to relieve their recurrent headaches (Dunn-Geier, McGrath, Rourke, Latter, & D'Astous, 1986; Gladstein & Holden, 1996; Holden, Rawlins, & Gladstein, 1998; Holden, Gladstein, Trulsen, & Wall, 1994; King & Sharpley, 1990; Larsson & Melin, 1988b; Reid, Gilbert, & Mc Grath, 1998; Van der Bree, Passchier, & Emmem, 1989). In a study by Holden and co-workers (1998), relaxation was used as a coping strategy by 82% of children with recurrent headache visiting a clinic, and the great majority (90%) found this strategy helpful. The authors noted that both active (problem solving) and avoidant strategies (wishful thinking) were used more often while negative strategies such as self-criticism were used relatively seldom. Boys who perceived control over their headache used more active coping strategies while females who perceived little control over their headache used more active coping strategies. In a Swedish study, Larsson (1988) found that coping strategies like going to bed and taking medication were the most commonly used strategies that helped about every second time. "Trying to relax" was reported to be a strategy that was used quite often but with a less positive outcome. Similar results were found in two other studies (Holden et al., 1994; King & Sharpley, 1990) in that taking medication or going to bed were some of the most used strategies. Just to sit down or try to relax were also found to be common coping strategies in an epidemiological study (King & Sharpley, 1990) as well in a clinic study (Holden et al., 1994). However, no estimation of the helpfulness of the various strategies was reported. In these studies a variety

of items for assessing coping strategies have been used, and the instruments have not been specifically developed for pain problems. The number of items and the operationalisation of the various coping strategies also differ between the studies. Finally, on the basis of these studies, no consensus about the relative effectiveness of the various coping strategies can be reached.

Conceptualisation of the influence of stress and coping among headache sufferers

Although several possible headache triggers exist, few have received support in empirical research. In several studies, adolescents with recurrent headache report more stress than those without headache (Bener et al., 2000; Langeveld, Koot, & Passchier, 1999). An explanation of how stress contributes to headache has been offered by Patricia Mc Grath (2001). Rather than highlighting the stressor itself, she suggests that the individual's reaction to different types of situations or "stressors" and the use of subsequent coping strategies may differ between recurrent headache sufferers and individuals not suffering from headache (McGrath & Hillier, 2001). According to this model, the situation ("stressor") is anxiety provoking and the child uses an inappropriate coping method for dealing with the situation. As a consequence, anxiety increases and headache develops. When this happens, the child gets a temporary reduction of anxiety and headache by withdrawing from the situation. However, this withdrawal sets the occasion for reinforcement of future problems and an evil circle of headache complaints evolves (see Figure 2). Teaching the child/adolescent a more appropriate way to cope with "stressors" or anxiety provoking situations should therefore be an important focus of interventions aimed at relief of recurrent headache.

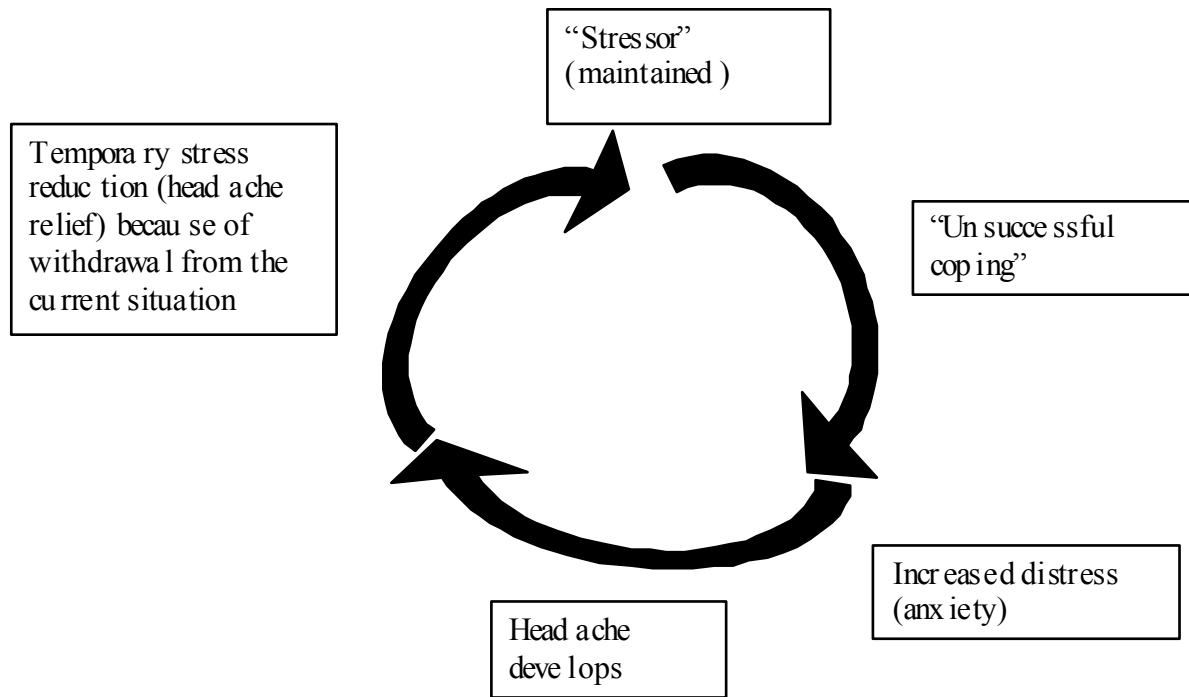


Figure 2. Schematic model depicting the influence of unresolved stress in provoking and maintaining headache complaints (slightly revised from the original model Mc Grath and Hillier 2001, p 89.).

Pain Coping Questionnaire, PCQ

Recently, a new instrument, the Pain Coping Questionnaire (PCQ) was developed by Reid and co-workers (1998) to assess children's coping with recurrent or chronic pain. The rationale for developing such an instrument was the lack of an easily administered method for assessment of coping strategies across different pain types and age groups. The intention was to include the most widely used coping dimensions: approach/avoidance as well problem-/emotion-focused styles and combinations thereof. Approach coping strategies are directed toward the stressor, while avoidance strategies aim at withdrawal from the stressor. Emotion-focused avoidance includes only coping strategies by which emotions are not regulated, while emotion-focused-approach coping includes more active types of emotional coping strategies such as for example positive self-statements. Among healthy students, these authors found that more approach coping as well as problem-focused avoidance correlated positively to pain

controllability and the effectiveness of the coping strategies. In a second study (Reid et al., 1998), they also found that emotion-focused avoidance for dealing with pain was related to more depression and anxiety among children with headache or arthritis. The use of approach coping was significantly correlated with pain controllability and perceived effectiveness of the used strategies among headache sufferers.

In conclusion, recurrent headaches, a very common problem among adolescents, have been successfully treated with relaxation training to be applied as a pain coping strategy in every day life. Whether other types of coping strategies are effective for adolescents with recurrent headaches is basically unknown due to limited research. Until recently, no pain coping assessment instrument for adolescents has been available in Sweden. Further, it is still unknown whether coping strategies commonly used by children differ in their effectiveness and whether adolescents with common types of pain, i.e. headache and abdominal pain, respond differently to various coping strategies.

To date, only limited information is available regarding the areas in which adolescents perceive that they are disabled by their recurrent headache. Increased knowledge about coping strategies and disability in daily life might lead to better care and treatment. Although relaxation has proven to be effective, this treatment is not available to most headache sufferers during childhood or adolescence. Generally, relaxation treatment is administered to individuals outside school settings, and primarily by professionals such as psychologists and physiotherapists. For such a prevalent health problem as recurrent headaches, the development of cost-effective treatment approaches is an important task. One possible approach would be to offer relaxation treatment within school health care, administered by the school nurses to reach a greater number of students with frequent and disabling headaches.

AIMS

The general aims of the present thesis are:

First, to estimate the prevalence of recurrent headaches within a school population in comparison with other types of pain, and in addition to describe the psychosocial impact of different types of pain. Second to describe the psychometric properties of the Pain Coping Questionnaire, and the use and efficacy of various coping strategies as reported by adolescents when having a recurrent pain such as headache, abdominal or back pain.

Third, to evaluate the effects of relaxation treatment as compared to a waiting-list control condition among 13-19 year-old adolescents with recurrent headache. Fourth, to evaluate the efficacy of relaxation training administered in a “real world setting” by school nurses to adolescents suffering from recurrent headaches.

Finally the findings will be discussed in the light of various perspectives on coping.

Specific aims are:

1. To estimate the prevalence of headaches as reported by adolescents in a school population and compare these estimates to estimates for other common pain problems (Study I).
2. To examine gender and age differences with regard to the frequency of headache and other types of pain (Study I).
3. To compare adolescents with frequent headache to those with other pain problems concerning levels of depressive symptoms, anxiety, disability and perceived parental illness behavior (Study I).
4. To evaluate the psychometric properties of the Pain Coping Questionnaire in a school sample of adolescents (Study II).

5. To compare adolescents with headache to those with other types of pain concerning their differential use of coping strategies, and the reported effectiveness of such strategies (Study II).
6. To evaluate the efficacy of relaxation training for adolescents having migraine combined with tension-type headache as compared to a waiting-list control condition (Study III).
7. To evaluate whether migraine and tension-type headaches are affected differently by relaxation treatment (Study III).
8. To examine whether relaxation affect the various characteristics of headaches differently (Study III).
9. To evaluate the effectiveness of relaxation training as administered by school-nurses within regular school health care (Study IV).
10. To evaluate the extent to which outcomes of such treatment are related to headache diagnosis (Study IV).
11. To examine the extent to which predictors of treatment outcome can be identified (Study IV).
12. To study maintenance of treatment effects at a 5-6 month follow-up evaluation (Study IV).

METHOD

Designs and subjects

Studies I and II

Studies I and II comprised a convenience sample from eight schools, from which four classes at each school were randomly selected. Seven hundred and ninety-three adolescents from two cities in the middle of Sweden, Gävle and Uppsala (90,501 and 188,478 inhabitants, respectively) were included (46% and 55%, from each city, respectively). The participants

were 13-19 years old ($M=15.8$, $SD=1.6$) and the sample consisted of 49% girls ($n=385$) and 51% boys ($n=407$). The pupils attended four secondary schools ($n=423$, grades 7-9) and four high schools ($n=370$, grades 10-12) representing 53% and 47% of the whole sample, respectively. The schools included had theoretical ($n=256$, 69%) as well as vocational programs ($n=114$, 31%).

Study III

Study III used an experimental between-group design with pre- and post treatment assessments. Maintenance of improvement was evaluated 8-12 months after termination of treatment for 20 subjects. A total of thirty-six subjects aged between 13 and 18 years (25 girls and 11 boys) were included in the study. Thirty-one had both migraine and tension-type headache and five subjects had migraine only. Fifteen girls and 5 boys were randomly assigned to relaxation and 10 girls and 6 boys to a waiting-list group. Inclusion criteria were a headache history of at least 6 months and fulfillment of the diagnostic criteria for migraine or both migraine and tension-type headache, in addition to experiencing migraine attacks at least twice a month. Exclusion criteria were somatic or psychiatric diseases.

Study IV

Study IV used an experimental design with pre- and post treatment assessments. Maintenance of improvement was evaluated 5-6 months posttreatment. Sixty-three subjects (age 13-18 years) were included in treatment. A post hoc comparison group of 41 nontreated subjects was included with the same distribution of age, sex and headache type as those in the treatment sample. Nine subjects had migraine only, 32 had tension-type headache and 22 had a mixed diagnosis (migraine and tension-type headache). The three diagnoses were combined into two groups; combined migraine and tension-type headache 49% ($n=31$) and tension-type headache

51% (n=32). Inclusion criteria were a headache history of at least 6 months and fulfillment of the diagnostic criteria for either tension-type headache or migraine or both migraine and tension-type headache, in addition to experiencing migraine attacks at least twice a month. Exclusion criteria were somatic or psychiatric diseases. Forty-nine percent of the subjects in the post hoc comparison group (n=20) had migraine and tension-type headache and 51% (n=20) had tension-type headache. The distributions of the two headache diagnoses were identical in the treatment and post hoc comparison group. Two of the subjects in the treatment and two in the comparison group were boys.

Out of 37 school nurses invited to participate in the study twenty-two school nurses stated that they were interested in participating in the study. These were randomly assigned to administer one of two types of relaxation treatment. However, eleven school nurses did complete their participation (see Figure 3). Oral as well as written instructions about adolescent headaches were given to the nurses. For both types of relaxation, the instructions were the same except for the contents of the treatments that differed between applied relaxation and visualized relaxation training procedures.

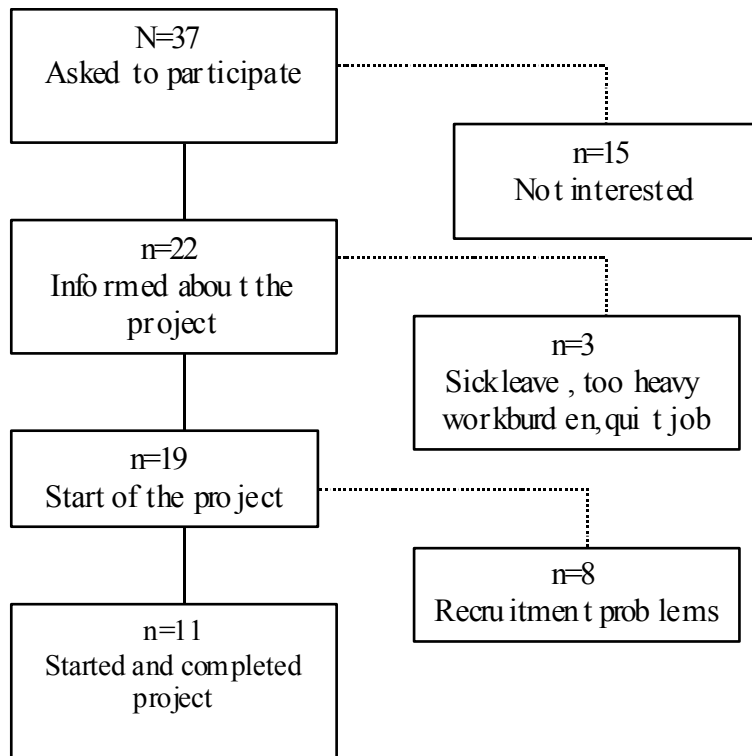


Figure 3. Flowchart for inclusion of school nurses in Study IV.

PROCEDURES

Studies I and II

Initially, written information was sent to the principal at each school, who later was contacted by telephone and asked about consent to the study. In the next step, letters were sent to all class teachers, who later were contacted by telephone for permission to class admission. The questionnaires were administered either by two psychology students or by a psychologist (ÅF), and were filled out during one school lesson (40 minutes). All students received written as well as oral information about the study. Those who were absent during administration were later asked to fill out the questionnaire by the classroom teacher, who were provided with written instructions and a prepaid envelope to be returned.

Altogether 124 (15.6%) of the eligible students did not participate in the study. One hundred and thirteen of the students were absent from school on the day of data collection. Common reasons for absences were illness, truancy or that some of the students were taught in small groups because of extra needs. Eleven students (1.3%) did not wish to complete the questionnaire. After three weeks, 42 subjects from two classes were reassessed to ascertain item and questionnaire reliability.

Study III

The relaxation treatment was administered during 8-10 sessions (about 45 minutes each) and included the following sessions that were given in sequence:

Session 1: Information on and rationale of treatment.

Session 2: Progressive relaxation, focusing on contracting and relaxing different muscle groups.

Session 3: Short version of progressive relaxation, focusing on relaxing different muscle groups without contracting.

Session 4: Cue-controlled relaxation, where a "cue-word" i.e. "relax" was established as a cue for a state of relaxation.

Session 5-6: Differential relaxation, introducing relaxation while walking and moving different parts of the body.

Session 7-8: Short relaxation technique, using breathing to relax rapidly.

Session 9: Application of relaxation techniques in everyday life situations at early signs of headache and increased muscle tension.

Session 10: Maintenance of skills.

For practical reasons, the treatment was performed both in small groups and in an individualized format. For eight participants (40%), the treatment was conducted in small

groups at their own schools, and for 12 subjects (60%) treatment was performed individually at the departments of Psychology or Public Health at Uppsala University. This was necessitated by the two recruitment strategies used and that participants recruited by advertisements in the local newspaper could not be treated in groups because of practical reasons. All treatment administered during school hours was conducted by three psychologists each treating approximately one third of all subjects.

Study IV

Relaxation training consisted of one of two forms of audiotaped instructions administered during six biweekly sessions each. These will hereafter be referred to as applied and visualized relaxation, respectively. At the start of treatment the adolescents received written instructions (two pages) about each session. They kept these instructions for the whole treatment period. Applied relaxation is a method frequently used in previous studies (Larsson & Carlsson, 1996; Larsson et al., 1987; Larsson & Melin, 1986), while visualized relaxation was designed for this project (see descriptions below).

Applied relaxation

The aim was to teach the adolescents a specific ambulatory relaxation method to be applied in daily life. During sessions 1-4, subjects were instructed to practice at home at least twice daily. During sessions 5 and 6, subjects were instructed to practice 15-20 times a day.

Session 1: Progressive muscle relaxation in seating position focusing mainly on the upper part of the body, especially the muscles in the face and neck region.

Session 2: Progressive muscle contraction without tensing (whole body).

Session 3: Diaphragmatic breathing and the cue word “relax”.

Session 4: Relaxation during activity (reading, standing and walking).

Session 5: Short form of relaxation with breathing (30-40 seconds) and activity.

Session 6: Application of relaxation at early signs of muscle tension or stress.

Relaxation with visualization

The aim was to teach the adolescents a general type of relaxation. No instructions about home training or how to apply relaxation outside the sessions were given at any stage of the training.

Session 1: Relaxation in the lying position. Subjects were instructed to relax different parts of the body, but there was no mention of progressive techniques, neither did subjects receive any information about practicing the skills at home.

Session 2: Relaxation in a sitting position. Instructions to subjects about relaxing different parts of the body, but no specific statements on how to do it.

Session 3: Relaxation in a lying position with guided imagery including a detailed description of a sunny beach.

Session 4: Relaxation in a sitting position with guided imagery.

This included the same instructions as above (session 3) but now in a sitting position.

Session 5: Attention directed toward something outside body with “your own imagery” (a positive memory, a recurrent theme, eg.waves coming into the beach)

Session 6: “Your own imagery” with eyes open. Subjects were instructed to find her/his own imagery while still keeping the eyes open.

Assessment instruments

An overview of all the assessment instruments used is given in Table 3.

Frequency and severity of pain (Studies I and II)

The participants were asked whether they experienced pain at the time of assessment (Studies I and II). This question was answered with a “No” or “Yes”, and if positively endorsed, the student specified the type of pain. Students also rated the frequency of headache and six other pain complaints: abdominal, muscle, back and joint pain, in addition to tooth ache and ear pain, on a 1-5 scale: 1=“Seldom or never”, 2= “One to three times a month”, 3= “Once a week”, 4= “Several times a week” and 5=“Daily”. A rating of 3 or more was defined as a frequent pain problem and a rating of 2 or less was considered as an infrequent pain problem.

The students also rated the pain problems according to how troublesome they were on the following scale: 1= “No problem at all”, 2= “Minor problem” 3= “Fairly problematic”, 4= “Quite a lot problematic”, and 5= “Extremely problematic”. Frequency and perceived problems with pain were summarized into a pain index. High test-retest correlations were obtained for headache ($r=0.83$, $p<0.001$), back pain ($r=0.83$, $p<0.001$), and joint pain ($r=0.70$, $p<0.001$). For tooth ache ($r=0.64$, $p<0.001$), muscle pain ($r=0.59$, $p<0.001$) the correlations were somewhat lower and for abdominal pain and earache, test-retest reliability was even lower ($r=0.40$, $p<0.01$, and $r=0.46$, $p<0.05$, respectively).

The Pain Coping Questionnaire (PCQ) (Studies II and IV)

The PCQ consists of 39 questions describing different coping strategies used by a child or an adolescent when in pain, and was developed by Reid and collaborators (1998). After the initial prompt: “When I am in pain for a couple of hours or days, I...”, subjects were asked to rate how often they used each coping strategy on the following five point scale: 1= “Never”, 2= “Almost never”, 3=“Sometimes”, 4= “Often”, and 5= “Very often”. The PCQ consists of the following eight subscales: information seeking, problem solving, seeking social support, positive self-statements, behavioral distraction, cognitive distraction, externalizing, and

internalizing/catastrophizing. These scales were found to have high internal consistency in that Cronbach alphas were: 0.79-0.94 (Reid et al., 1998).

Based on these eight scales, three higher-order subscales “Approach”, “Problem-focused avoidance”, and “Emotion-focused avoidance” have been extracted through factor analysis by Reid et al. (1998)(see Table 5 for description of the eight scales included in each higher-order scale). The sum scores for each scale were added and divided by the number of items included in each scale. The total sum varies between 1 and 5, a higher score indicating a more frequent use of each strategy.

Efficacy of pain coping strategies (Study II)

In addition to the questions concerning coping strategies, the PCQ also consists of seven questions about how effectively they handled the pain on a five-point scale, where a higher sum score indicates a greater sense of effectiveness of each strategy. In this study only one question was included: “What I did when I was in pain was helpful”.

Center of Epidemiologic Studies: Depression Child (CES-DC) (Studies I and II)

The CES-DC is an instrument for self-rating of depressive symptoms originally developed for adults (CES-D) (Weisman, Sholomskas, Pottenger, Prusoff, & Locke, 1977) which has been revised for use with adolescents (Roberts, Lewinsohn, & Seeley, 1991; Schoenbach, Kaplan, Grimson, & Wagner, 1982). It consists of 20 statements, and subjects are asked to rate the frequency of their symptoms during the last week on the following scale: 0= “Not at all”, 1= “Few times”, 2= “Now and then”, 3= “Often”. All ratings are summarized into a total score with a range of 0-60. In an epidemiological study of 16-17 year-old Swedish students, Cronbach’s alpha was .91 (Olsson & von Knorring, 1997). The CES-DC was found to be sensitive in detecting a depressive disorder. In the present study Cronbach alpha was 0.86.

Revised Child Manifest Anxiety Scale (RCMAS) (Studies I and II)

The RCMAS is one of the most widely used instruments to measure anxiety symptoms in children and adolescents (Reynolds & Richmond, 1997). It consists of 28 items to be answered by subjects with “No” (0) or “Yes”(1). The item scores are summed into a total score ranging from 0 to 28. Examples of questions are: “I get nervous when things do not go the right way”, “I often worry about something bad happening to me”. The RCMAS has been found to have good psychometric properties with an internal consistency estimate of 0.85 (Reynolds & Richmond, 1997). In the present study Cronbach alpha was 0.88.

The Functional Disability Inventory (FDI) (Studies I, III and IV)

The FDI was developed for assessment of functional disability among children and adolescents when being sick or ill (Walker & Greene, 1991). It covers several domains of consequences of illness such as physical and psychosocial functioning in everyday activities. Functional disability is defined as troubles in age-appropriate physical and psychosocial functioning due to physical health status. In the present study the original instructions about feeling sick or not well were rephrased to address subjects’ experiences of pain. The FDI consists of 15 items describing influences on common daily activities. Each item is scored on a 5-point scale, where 0 represents “No problem” in performing the activity and 4 represents “Impossible to perform” the activity. Total sum scores vary between 0 and 60. Internal consistency was found to be high in that Cronbach alpha was 0.91.

Illness Behavior Encouragement Scale (IBES) (Studies I, II and IV)

The IBES consists of 12 questions about what adolescents perceive that parents do when the adolescent is having a cold or gastrointestinal symptoms (Walker & Zeeman, 1992). It measures positive consequences of parent behaviors when the child is sick, for example,

he/she does not have to do regular household chores or gets more attention from the parents. The questionnaire is based on social learning theory and assesses how parent-child interactions may contribute to the development of children's illness behavior. For the present study, the questions were rephrased to deal with adolescents' pain experience and their responses were rated on a five-point scale: 0= "Never" and 4= "Very often". Total sum scores range from 0 to 48 and a higher score indicates more positive consequences for the child. Cronbach alpha was 0.66.

Medication usage, school absence and leave (Studies I and II)

The subjects were asked to estimate the frequency of their use of pain-killing medication on the following scale: "Never/Seldom", "1-3 times a month", "1-3 times a week", "Almost everyday" and "Everyday". School absence was estimated by asking the student about the number of school hours during previous month they had been absent due to pain, and their responses were rated on the following scale: "0 hours", "1-5 hours", "6-10 hours", "More than 10 hours". In addition, school leave was estimated by asking the students about the number of times during the previous month they had left school due to pain and to grade their responses on the following scale: "Never", "1-3 times", "4-6 times", "More than 6 times".

Headache activity (Studies III and IV)

A headache diary was used in which participants rated the intensity of their headaches four times daily (breakfast, lunch, afternoon and bedtime). The headache intensity scale ranged from 0 to 5 (6-point likert scale) and the scores were defined as: 0="No headache", 1="Very mild headache", 2="Mild headache", 3="Moderate headache", 4="Severe headache" 5="Very severe, incapacitating headache".

For Study III each subject was asked during the interview with the physician if she/he had any of the two types of headaches. If positively endorsed, the participants were instructed to mark an "M" if the headache was of the migraine type, and "T" for tension-type headache in all their daily recordings in the diary.

The following outcome measures of headache activity during the week were used:

- (a) Headache sum (total measure of headache activity was estimated by summarizing all weekly headache intensity scores four times a day for each week, range 0-140);
- (b) Headache frequency was estimated by counting the number of discrete headache attacks each day. To be qualified as a separate attack, the recordings had to be zero before and after each attack (range 0-14/week);
- (c) Headache-free days was computed by summing the days without headache recorded during the week;
- (d) Headache duration was calculated as the mean length of all headache episodes during the week (range 0-28 /week); each duration episode is equivalent to 5 hours.
- (e) Peak headache intensity was estimated by using the single highest headache rating per week (range 0-5).

The mean values for these headache characteristics were calculated in the pre, post and followup measurements. A clinically meaningful improvement was defined as a reduction of 50% or more in total headache activity between pre and post assessments.

The subjects were also asked to record all their usage of palliative medication. All headache recordings were performed four weeks before and after treatment and at the 6 (Study IV) and 8-12 (Study III) month follow-ups.

Table 3. Overview of instruments used in Studies I-IV.

Study				
Instruments	I	II	III	IV
PCQ		X		X
CES-DC	X	X		
RCMAS	X	X		
FDI	X	X		X
IBES	X	X		X

Statistical methods

Study I

Analysis of variance (ANOVA) and t-tests were used to estimate differences between group means for continuous measures, while the Kruskal-Wallis rank test was used for ordinal-level variables. Chi-square test was used to estimate associations between categorical variables, while the Pearson's product-moment correlation coefficient was used for continuous variables.

Study II

Principal component analysis (PCA) was used to extract the factors of the PCQ with a subsequent oblique rotation method. Internal consistency was estimated by the Cronbach's alpha coefficient, and Pearson product-moment coefficients were used to assess test-retest reliability. To analyze differences between group means, t-tests or ANOVAs were used with subsequent Spjotvoll unequal group post hoc tests when overall main effects or interactions

results were significant. Familywise Bonferroni corrections of the alpha-level were performed for multiple comparisons.

Study III

Chi-square tests were used to compare the two treatment groups with regard to the number of adolescents, who had achieved a clinically meaningful improvement or not. An improvement from pre to post measurement of 50% or more was defined as a clinically meaningful improvement. Between-group differences were estimated by one-tailed t-tests for pre-post (raw) gain scores with the various headache activity measures as dependent variables. Dependent t-tests were used to estimate the maintenance of treatment effects 8-12 months after treatment termination.

Percent improvement for the headache sum was calculated by using the formula:

$$\text{Percent improvement} = \frac{\text{Total headache sum before} - \text{Total headache sum after}}{\text{Total headache sum before}} * 100$$

Study IV

ANOVAS and independent t-tests were performed to analyze differences between groups across time. Chi-square tests were used to compare the treatment and post hoc comparison groups with respect to the number of adolescents who had achieved a clinically meaningful improvement. A improvement from pre-post measurement of 50% or more was defined as a clinical improvement, an improvement of 25%-50% was defined as a slight improvement, and improvement from 0% to 25% was defined as no improvement. An improvement of 0% or

less was defined as worsening of headache. Standard multiple linear regression was used to explore predictors of headache improvement.

Ethical considerations

The Research Ethics Committee at the Faculty of Medicine, Uppsala University, approved all studies. All subjects received written as well as oral information about the studies. The subjects were informed that participation was voluntarily and that participation could be terminated at any time without explanation. The subjects were also informed about the confidentiality of the results and that data would be analyzed and presented on a group level to eliminate the risk of identification of single individuals. In Studies I and II, the questionnaires were completed anonymously by all subjects, except for those 42 subjects who were retested. These latter subjects were assigned a number on a name list which was used to match their first and second test scores. After testing was complete the list was erased.

For Studies I and II, the Research Ethics Committee regarded the subjects themselves to be capable of deciding whether they wanted to participate or not, and that no parent consent was needed. For Studies III and IV, parents had to sign a consent form for subjects younger than 18 years of age for their participation.

RESULTS AND METHODOLOGICAL CONSIDERATIONS

Summaries of Studies I-IV

Study I: Psychosocial impact of headache and comorbidity with other pains among Swedish school adolescents

The first aim of Study I was to examine the frequency and severity of headache among school adolescents and its comorbidity with other pain types. Headache was the most common pain reported by adolescents. Thirty-three percent reported having headache at least once a week.

Only 1/3 of the subjects with headache reported having headache exclusively, while the rest reported one or more additional pains. The most common types of pains reported with headache were muscle and back pains followed by abdominal pain.

The second aim was to examine age and gender differences with regard to frequency of headache and other types of pain. Generally, girls reported a higher number of pains than boys. Almost twice as many girls (42%) as boys (24%) reported headache at least once a week. There were no age differences concerning frequency of headache, headache was as common among the younger as among the older adolescents.

A third aim was to investigate the potential psychosocial impact of headache (i.e. on anxiety, depression, functional disability, and experienced illness behavior encouragement from the parents), in addition to school absence due to headache and the use of painkiller medication. The results showed that adolescents with frequent headaches had significantly higher scores than those with infrequent headache on the RCMAS and CES-DC. Significant main effects were found for gender in that girls had higher scores than boys. However, no interaction effects were found between gender and headache frequency. The results also showed that adolescents with frequent headache and no present pain at assessment had significantly higher scores on the FDI than those with infrequent headache. Also, a significant main effect was found for gender as girls had higher scores than boys. The results of a two-way ANOVA showed a significant interaction between gender and headache combined with other pains on the FDI. Subsequent post hoc test showed that girls with frequent headache only had more functional disability than boys did. For boys with frequent headache or headache combined with other pains functional disability level was higher when combined with more pains, but lower for girls. Overall, adolescents with frequent headache had more functional disability as

reflected by statistically significant differences on all the individual items on the FDI as compared to subjects with infrequent headache. Of the various types of pains, headache frequency showed the highest positive correlations to medication usage and leaving school. Additionally, there was a positive correlation between headache and school absence. Higher correlations between headache, school absence and medication use were found for boys, while girls reported significantly more school absence than boys as well as leaving school more often due to pain. Of subjects with frequent headache, 23% reported taking medication 1-3 times a week, while 5% reported using almost daily or daily medication.

Study II: Pain coping strategies among Swedish adolescents as measured by the Pain Coping Questionnaire

A fourth aim was to examine the psychometric properties of the PCQ in a sample of Swedish school adolescents. The results of a principal component analysis (PCA) showed an eight-factor solution to be the most parsimonious model. The factors extracted were *social support*, *behavioral distraction*, *externalizing*, *positive self-statements*, *information seeking*, *internalizing*, *problem solving* and *cognitive distraction*. These eight factors accounted for 64.4% of the total variance. For eigenvalues, see Table 4. In a subsequent PCA analysis including the scores of these eight scales, a three factor solution of higher-order factors was found to be the best fitting model (see Table 5). Internal consistency was satisfactory for all factors, ranging from 0.72 to 0.90. Test-retest reliability was moderate to high for all scales ranging from 0.45 (*seeking social support*) to 0.81 (*behavioral distraction*).

Table 4. Eigenvalues, percent explained variance and cumulative

percent of the different factors in the PCA.

Factor	Eigenvalue	% explained	Cumulative percent
1	9.46	24.24	24.25
2	5.13	13.15	37.40
3	3.30	8.46	45.86
4	2.04	5.24	51.09
5	1.53	3.93	55.03
6	1.44	3.70	58.73
7	1.16	2.99	61.72
8	1.06	2.71	64.43

Table 5. Higher-order factors extracted out of the eight factors by using PCA.

Coping scales	Higher-order factors		
	Approach	Problem-focused Avoidance	Emotion-focused avoidance
Seeking social support	0.77		
Information seeking	0.81		
Problem solving	0.85		
Positive self-statements	0.58	0.52	
Behavioral distraction		0.82	
Cognitive distraction		0.90	
Externalizing			0.90
Internalizing			0.72
Percent explained variance	32%	23%	17%

A fifth aim was to examine adolescent use and efficacy of coping strategies related to type of pain, gender and age. The results showed significant differences between pain types for adolescents' use of *Internalizing* coping strategies. Subjects with abdominal pain used such coping strategies significantly more often than those with muscle and back pain symptoms. For the higher-order factor *emotion-focused avoidance*, a significant difference was also

found in that subjects with abdominal pain used this strategy significantly more often than those with muscle pain and headache.

Girls used the coping strategies *seeking social support*, *positive self-talk*, *internalizing*, *information seeking* and *problem solving* significantly more often than boys. In addition, girls used *approach coping* as well as *emotion-focused avoidance* strategies significantly more often than boys. *Behavioral distraction* was reported to be used more often among 13 and 14 year-olds than 16 year-olds.

Subjects with frequent headaches reported the use of *internalizing coping* strategies more often than those with infrequent headaches. A similar difference between the two groups was found for the higher-order factor *emotion-focused avoidance*.

Overall, *problem solving* was regarded to be the most helpful coping strategy across pain types. The use of this strategy correlated positively with efficacy for all pain types except for girls with abdominal or joint pain. The use of *Internalizing* coping strategy correlated negatively to efficacy among girls with abdominal, joint and back pain. These correlations were higher for girls with back pain than for girls with abdominal and joint pain. The use of *internalizing* and *externalizing* coping strategies correlated positively to depressive and anxiety symptoms and functional disability, moderately for depressive and anxiety symptoms and lower for functional disability. The use of the *seeking social support* strategy also had a low, but positive correlation to depressive symptoms and parental behavior encouragement. Among the higher-order factors scale, use of the *approach* coping strategy correlated positively to depressive symptoms and illness behavior, and *emotion-focused avoidance* was positively related to depressive symptoms, anxiety and functional disability.

Study III: Does relaxation treatment have differential effects on migraine and tension-type headache in adolescents?

The sixth aim was to examine whether a standardized relaxation treatment was more effective than a waiting-list (WL) condition in reducing overall headache activity in adolescents suffering from migraine only or migraine combined with tension-type headaches.

The results showed that adolescents in the relaxation group had improved significantly more than those in the WL condition on the mean total headache sum. A significantly higher proportion of subjects in the relaxation group (50%) had achieved a clinically meaningful improvement in total headache sum as compared to those in the WL group (12%).

Aim number seven was to examine the extent to which treatment effects would differ between the two types of headache, i.e. migraine or tension-type headache.

The results showed that gain scores for total migraine activity improved significantly more for adolescents in the relaxation group as compared to those in waiting-list group. Subjects in the treatment group also improved more on total peak intensity as well as on migraine intensity, but not on tension-type intensity. Frequency of migraine improved significantly more for those treated with relaxation than for those in the WL group.

Aim number eight was to examine whether migraine and tension-type headache was differently improved by relaxation treatment. With regard to migraine activity, 69% of subjects treated with relaxation had achieved a clinically meaningful improvement as compared to 38% in the WL group. This difference approached significance ($p=0.07$). No significant differences between the two groups were found for tension-type headache in that

equal proportions of subjects in the treatment and WL group had achieved a clinically meaningful improvement (42% and 40%, respectively).

Study IV: Relaxation treatment administered by school nurses to adolescents with recurrent headaches

Aim number nine was to evaluate the effectiveness of two types of relaxation training when administered by school nurses. There were no differences between the three groups on pretreatment scores on headache sum, headache-free days or headache frequency. No significant differences between groups were found on any of these measures (pre-post gain scores). When combining the two treatment groups significant differences was found on total headache sum $t(102)=1.69$, $p<0.05$ and headache-free days $t(102)1.91$ $p<0.05$ (pre-post gain scores) compared to the non-treated post-hoc group (one-tailed). However, no differences on headache frequency was found between treated and untreated were found.

Aim number ten was to evaluate whether the different headache diagnosis were affected differently by relaxation. No differences regarding outcome of relaxation treatment on headache sum, headache-free days or frequency were found in regard to headache diagnosis.

Aim number eleven was to examine whether any variables could predict changes in headache sum after treatment. Two variables, functional disability and positive self-statements explained 29% of the outcome variance. $F=9.3$, $p<0.01$. The more functional disability before treatment the higher headache activity after treatment ($\beta=-0.35$; $SE=0.13$; $t=-2.69$, $p<0.05$), while more positive self-statements before treatment predicted a lower headache activity after treatment ($\beta=-0.33$; $SE=0.13$; $t=2.5$; $p<0.05$). The higher order-factor approach coping almost reached a significant contribution to the prediction of outcome ($R^2=0.27$, $p=0.06$).

Aim number twelve was to examine the long-term outcome of relaxation treatment. At the follow-up 5-6 months after treatment, there were still no differences in outcomes between treated subjects and those in the post-hoc comparison group (post-follow-up gain scores).

Methodological considerations

A number of methodological considerations could be put forth. One strength of Studies I and II is the fairly large sample size. The included subjects also cover the age span for the whole adolescent period providing good representativity. Further, it is possible to study developmental effects regarding, for instance, reported pains and the use of different coping strategies. Even if participants from only two cities were included in Study I and II these cities are quite different with regard to demographics. This should serve to improve external validity. However, no inferences about causal relationships between headache and the different measures are possible in a cross-sectional design since subjects were tested only once. A prospective study design including a headache diary and the psychological measures would improve possibilities to draw conclusions concerning such relationships.

The approach in Studies I and II where different types of reported pain were addressed provides further methodological strength. To include different pain types make it possible to study differences between pain types as well as between individuals concerning both frequency, but also concerning use of coping strategies and psychosocial well-being among different groups. A limitation of Studies I and II though, is the use of retrospective reports. By using such an approach there is a risk of biased estimates in the various pain complaints, which has also been pointed out previously (Van den Brink, Bandell-Hoekstra, & Abu-Saad, 2001). In the study by Van den Brink and co-workers (2001) an overestimation of especially

headache intensity and duration was found in a questionnaire compared to a diary. For headache frequency the median frequency was equal between diary and a questionnaire. The test-retest reliability in the present study was also high for most of the reports of pain symptoms indicating temporal stability of the adolescents' perceptions of their pains. Even if the use of a pain diary is likely to produce more valid and reliable pain information, the use of such an approach in studies like these may increase the risk for drop outs due to a more strenuous effort on the part of the adolescents. Such a design would also cost a lot more money.

A limitation of Study II is that the reported use of coping strategies only was related to one type of pain only. A more reliable way to assess such relationships would be to ask adolescents what type of coping strategies they use for each specific type of pain. Such an approach would also generate a higher number of possible responses to the coping strategies. The inclusion of a pain measure such as a visual analogue scale for rating present pain is also likely to increase the reliability of the data.

A strength of Study III is the inclusion of an assessment making possible to examine differential effects of relaxation on migraine and tension-type headache. The inclusion of a waiting-list control group also adds to the internal validity of Study III. The use of an experimental design with a relatively weak power, which still produced significant results, is another strength.

The use of diary recordings of headache complaints in Studies III and IV, where the subjects recorded their headache four times daily during four weeks, has been found to be the most reliable way to assess headache complaints (Osterhaus & Passchier, 1992). For example,

variations in frequency, duration and intensity can be more easily detected by such an assessment approach (Metsähonkala et al., 1997a).

Some limitations of Study III should be noted. At the follow-up assessment some subjects had problems differentiating between migraine and tension-type headaches, probably due to the use of mailed instructions. A better differentiation of the two headache types could probably have been attained with a personal contact, for example, by a phone call to remind the participants how to differentiate between migraine and tension-type headaches. Since the follow-up evaluation was performed in a later phase of the study, only 20 subjects out of the total of 36 were included in this assessment. However, other long-term studies of relaxation have shown maintenance of improvements at follow-up evaluations and our results are in line with these studies (Engel, Rapoff, & Rogot Pressman, 1992; Larsson & Carlsson, 1996; Larsson & Melin, 1986, 1989).

In Study IV relaxation was administered in the context of a regular school health service. Such a design has the disadvantage that the intervention is more difficult to control as responsibility for treatment is handed over to the school nurses. In addition, a relatively low participation rate among school nurses reduces the possibilities to generalize the results since it is likely that only the most motivated nurses were included. Less than half of those who initially expressed an interest to participate, did start the project at their school. Drop outs stated primarily a heavy work burden as the reason for nonparticipation. At the time of the study, each school nurse in Uppsala had approximately 800 students to handle, twice the recommended number of 400 (Wennerstrand, 2002). Many of the school nurses reported that they were not satisfied with their work situation. It is understandable that many hesitated to participate due to the extra work. Another problem was that school nurses often had

difficulties in recruiting a sufficient number of adolescents. This problem made it necessary to adjust the design since a sufficient number of students could not be recruited to the waiting-list group.

Conclusions and clinical implications

Based on the results of the four studies presented above, the following conclusions can be made:

The prevalence of reported weekly headache is high among school adolescents and in particular this holds true for girls. A major part of those suffering from frequent headaches also suffer from other types of pain. Because a greater number of pains were related to worse psychosocial functioning, it is suggested that adolescents should be routinely asked about the presence of other types of pain when presenting headache complaints.

Among subjects with frequent headache, functional disability was found to be higher in all specific areas covered by the FDI compared to those with infrequent headache. To routinely ask adolescents about which specific activities are incapacitated by the headache is therefore recommended. To specifically examine the daily restrictions that subjects experience have important implications for choosing appropriate target areas in the treatment of recurrent headaches among adolescents.

The Pain Coping Questionnaire (PCQ) is a valid and useful instrument for assessment of pain coping strategies among adolescents with different types of pain. It is suggested that more active strategies (approach coping), such as problem solving (Study II) and positive self-statements (Study IV) can be regarded as more helpful and covary with a better outcome. In

future research, changes of pain coping strategies over time should be assessed to find out whether such strategies are consistent over time, and whether they can predict the outcome of various types of treatment. If productive and helpful coping strategies can be identified, such information could have direct implications for development of new treatment strategies.

For adolescents with both migraine and tension-type headache, the results showed that half of the adolescents were clinically improved after relaxation training. The migraine component was positively influenced by this treatment, while tension-type headache was not affected. Since many adolescents with migraine also suffer from tension-type headache, it is important to pay attention to both types of headaches when treating adolescents with recurrent headache.

Relaxation used as a coping strategy when implemented in school health care by school nurses was not as powerful as desired. Based on our findings, it can not be recommended that relaxation training is administered to adolescents suffering from recurrent headaches as part of routine management within regular school health care. However, treatment methods based on different approaches, such as shorter forms of relaxation administered by different groups of professionals, with other instructions should be evaluated in future research. The active manner in which relaxation should be used (i.e. as a coping strategy) must be emphasized in such research.

DISCUSSION

General discussion

The reported headache frequency among adolescents and the higher prevalence rate among girls in Study I are well in line with previous epidemiological surveys (Kristjansdottir, 1997; Metsähonkala, 1997; Perquin et al., 2000). Further, in Study I the adolescents with frequent headaches also had significantly higher scores for anxiety and depressive symptoms than did subjects with infrequent headaches, findings well in line with previous reports in the field (Carlsson et al., 1996; Egger et al., 1998; Hunfeld et al., 2001; Karwautz et al., 1999).

Subjects with frequent headaches also experienced a stronger impact on their daily functioning as reflected by higher scores on all the individual items of the functional disability index. The impact on daily life among those with frequent headaches should be addressed more thoroughly in future research, particularly negative effects specifically related to headache. Important areas to examine would for example be to find out more about how concentration in classroom and social contacts are influenced by headache variables briefly assessed in the functional disability. Differences between boys and girls concerning these aspects is also important to address.

Cultural and parental influences as well as biological differences are factors that are worth interest in future research. The high comorbidity between frequent headaches and other types of pains found in Study I are other findings that should be explored further in future research.

In Study II, the conceptual basis of the Pain Coping Questionnaire was best described by an eight-factor solution and three higher-order factors. These results are almost identical to those

reported in a study by the originators of the questionnaire (Reid et al., 1998), demonstrating that the instrument has stable qualities. The factors seem to be adequate in that they are almost identical to those of the original questionnaire. The correlations between the different factors and the various psychological measures, i.e. depressive symptoms and anxiety, were in the expected direction. This is also true for the factors that were associated with the reports of efficacy of the pain coping strategies. Until now, no comprehensive pain coping measure for adolescents has existed in Swedish. However, the PCQ should also be tested and validated in Swedish adolescents suffering from other types of pain and in clinical samples.

The psychometric properties of the PCQ instrument (Study II) seemed to be stable although some of the subscales showed lower test-retest reliability than others. For example, seeking social support showed the least stability (0.45). These findings might reflect differences in the temporal stability of the coping strategies. Since other people are involved in a strategy like seeking social support the use of such strategy might be related to whether the child feels safe with the person from whom support is sought. Therefore this strategy may vary more between situations than is true for other strategies such as e.g. positive self-statements. It would be wise to assess coping from both a process and a state perspective to find out more about the stability in various pain coping strategies.

The overall results of Study III showed that total headache activity among adolescents 13-18 years of age suffering from frequent migraine (at least two attacks per month) were significantly more improved after relaxation training as compared to subjects in a WL condition. In line with previous clinic-based outcome studies, these results show that relaxation is an effective method even for adolescents suffering from migraine in a non-clinical school sample. Of particular importance is that half of the adolescents treated with

relaxation had achieved a clinical improvement as compared to only 12% in the waiting-list group. These results are also in line with outcomes of school-based studies showing similar improvement after relaxation treatment (Larsson, 1995; Larsson & Melin, 1989).

Study III also examined whether treatment outcomes differed between migraine and tension-type headaches. Total headache activity, as well as migraine activity, were reduced for those with migraine treated with relaxation, but not for those with tension-type headaches. Further, for subjects with migraine in the treatment group, intensity was reduced more after treatment than for those with tension-type headache. The frequency of migraine was reduced significantly for those treated with relaxation as compared to those in the WL group. The reason for this may be that migraine is a more distinct headache with a clear onset and higher intensity. Thus, it might be easier for adolescents to detect and apply rapid relaxation techniques at the first signs of migraine than for tension-type with a gradual onset. Further, the higher intensity levels of migraine provide a larger span for improvement. Also, migraine subjects' motivation to use relaxation in everyday life is possibly higher than for tension-type headaches with lower intensity levels. Larger improvement among school adolescents with severe headaches have also been found in previous studies of relaxation (Larsson & Melin, 1988a), results in line with the present findings. In a study on physiological and psychological reactivity to stress when performing a speech among adult headache sufferers (Holm, Lamberty, McSherry, & Davis, 1997), it was found that those with migraine reacted differentially psychologically from those with tension-type headache. Subjects with migraine tried to adjust their ratings of coping success based on feedback they received on their performance, while the ratings of subjects with tension-type headache did not relate to type of feedback and rate of success. A conclusion of the aforementioned study was that subjects with tension-type headache were more resistant to environmental information and performed their

rating on the basis of personal beliefs rather than on feedback information in the actual situation. Such a psychological mechanism could also partly explain the results obtained in Study III. In the light of these results, it is suggested that the aims for relaxation treatment should differ between the headache diagnoses. For adolescents suffering from frequent migraine, the prime aim may be to lower the frequency and intensity of the headache, whereas for subjects with daily or almost daily tension-type headaches, the primary aim of relaxation might be to reduce the frequency rather than the intensity of the headache. To examine what aspects of the headache adolescents report as most debilitating is an area that should be examined in further studies.

Outcomes 8 to 12 months after treatment (Study III) showed that the improvements achieved remained stable over time an observation which is in line with other reports (Engel et al., 1992; Larsson & Carlsson, 1996; Larsson & Melin, 1986, 1989).

The results of our school-based effectiveness study (IV) showed significant but modest improvements of headache activity after treatment as compared to an untreated post-hoc group and no differences between the two types of relaxation approaches.

A positive finding was that the headache sum and number of headache-free days increased among treated subjects as compared to those in the untreated comparison group on pre-post gain scores. This finding indicate that relaxation treatment was helpful for some subjects, even though the effects were small. It may be that relaxation strategies work better for some adolescents than for others. Some students may have misunderstood the instructions, thus achieving no improvement due to relaxation training. If failing to relax, tension may rise resulting in loss of control and aggravation of headache symptoms. A way to further examine this issue would be to let adolescents record their use of relaxation training techniques and to

write down what works and what does not. It would also be of interest to check how the school nurses encouraged the subjects' to practice relaxation and their skills.

Several school nurses responsible for treatment in Study IV claimed a heavy work burden as a reason for not participating in the project. Further, it might be that the project had a too ambitious design, which may have contributed to the school nurses' non-participation and attrition as well as the modest results of relaxation training. For example, besides providing actual treatment, the school nurses were responsible for having children completing a large number of questionnaires, conducting a clinical interview, and collecting the weekly diaries four weeks before and after treatment. It can not be ruled out that the strain from these tasks had a negative impact on their motivation. Specifically, many of the school nurses reported contacting and scheduling adolescents for assessment and treatment sessions to be a heavy burden. Although the checklists were filled out properly by the nurses and the time schedule of the treatment sessions was kept according to instructions, the treatment sessions may still not have been performed according to instructions. However, both types of relaxation were based on audiotaped instructions and the instructions were given in a standardized manner. One way to find out more about the administration of the treatment would have been to use video taping or live supervision of the sessions. However, it is possible that such methods would have distracted the adolescents as well as the nurses from their tasks at hand. Another way to examine the importance of the therapists' role would be to compare the same treatment administered by a graduate student and an experienced psychologist.

In previous school-based studies on relaxation among adolescent headache sufferers, good effects have been achieved with relatively inexperienced graduate psychology students and with relaxation delivered in a self-help, home-based format. In the present study, relaxation treatment was administered at school by regular school nurses and not by an external therapist

or outside the school setting. In a similar study of relaxation training administered by three selected school nurses, two thirds of the 10-15 year-old students were clinically improved (Larsson & Carlsson, 1996). The same applied relaxation training procedures were used producing much higher improvement rates. In the study by Larsson and Carlsson (1996) only chronic tension-type headache sufferers were included whereas in the present study both migraine and tension-type headache were included. However, based on the same headache diary recordings headache activity i.e. headache sum or frequency or headache free days did not differ between the studies prior to treatment, thus indicating that the samples were similar. In the study by Larsson and Carlsson (1996), outcome was based on the headache diary only. This is much easier for the nurses to handle than the extensive measures used in our study. Further, in the study by Larsson and Carlsson (1996), the children were also slightly younger (10-15 years of age) than in present study sample which may have influenced the results.

A lower student motivation for attending treatment might also be a reason for the modest results obtained in Study IV. In another school-based study, it was found that the majority of adolescents visiting a school nurse office presenting with recurrent headaches were interested in either resting or going home, and only few were interested in talking to the nurse (Schneider, Friedman, & Fisher, 1995). It is possible that the school nurse offering students a possibility to rest may negatively affect their motivation for taking an active part in trying to deal with their headaches. Also, the school nurses' recruitment of students may have resulted in a somewhat different group than in previous school studies. For example it is possible that frequent school nurse visitors were included to a higher degree than those who came more seldom. The recruited group may differ from adolescents who take an active step in finding treatment. If adolescents were insufficiently motivated, an important ingredient of treatment would be to increase their interest and motivation, issues that were not specifically addressed

in the present study. It should also be mentioned that even though modest results were found personal contacts as well as informal evaluations indicate that the adolescents were pleased with the offered treatment.

The design of the project with a large number of assessments administered twice a week during sometimes hectic school days may have resulted in some tiredness among the participants.

Two predictors of headache improvement after treatment were identified, i.e. functional disability and the use of positive self-statements as a coping strategy. Thus, adolescents reporting higher disability before were more likely to have higher levels of headache activity after treatment. Various aspects of functional disability should be assessed before treatment and these aspects should also be specifically addressed in treatment. For adolescents with more positive self-statements before therapy there was a higher likelihood for headache sum improvement after treatment. This aspect is important to take into account in future studies.

None of the other coping strategies was found to predict outcome after treatment. A reason for this may be that different coping strategies fit different persons. However, some caution in drawing firm conclusions from these results is warranted due to a limited sample size.

Relaxation procedures can be seen as a coping strategy that might suit some adolescents better than others. Although modest changes were obtained in Study IV, the results of previous studies on children and adolescents with recurrent headache emphasize that relaxation can be a useful coping strategy. According to Mc Grath (2001) headache problems are triggered mainly by the “wrong” coping strategies and the subsequent withdrawal from the provoking situation is assumed to maintain and reinforce the headache problems. The persistence of

psychosocial problems among headache sufferers and withdrawal from social activities have been shown in a previous study (Hunfeld et al., 2002). However, some issues need to be discussed. For example, applied relaxation approaches used in situations with elevated stress or at early signs of headache is an example of an active (approach) coping strategy to deal with headache. The adolescents' use of an active approach such as problem solving was found to correlate with efficacy ratings for that strategy in Study II. In Study III, the outcome of relaxation as an applied skill showed positive effects as well. In Study IV positive self-statements contributed to the prediction of outcome. Both positive self-statements and problem solving are strategies that fall under the higher-order factor approach coping. Further, the higher-order factor approach coping almost reached a significant value in the regression equation in Study IV. One can therefore suppose that if problem solving is used as a strategy to deal with stress, the individual tries different ways to handle this until stress reduction is reached. To use problem solving as a strategy probably gives the individual an experience of a larger arsenal of strategies leading to a sense of control over the situation as well. Overall, the above results do indicate that the use of active ways of dealing with headache among adolescents is effective. Approach, rather than avoidant coping strategies, have been suggested as helpful strategies in previous studies on headache (Reid et al., 1998; Van der Bree et al., 1989). Since relaxation has to be learned problems might occur with different stages in this process. In Study IV less control was maintained over the different parts in treatment since recruitment and treatment was performed by a second part (the school nurses). For example, the method for teaching the skill may lead to unsatisfactory skills on the part of the student to correctly perform relaxation if the instructions are unclear. In such cases, relaxation may have no effect or even increase the headache problem.

The role of cognitive rather than physiological mechanisms related to the outcome of biofeedback has been shown in a few studies on adult headache (Andrasik & Holroyd, 1983; Holroyd et al., 1984; Rokicki et al., 1997). Rokicki and collaborators (1997) found that more than half of their subjects treated with biofeedback and relaxation improved by 50% or more. However, headache reduction was not related to reductions of either EMG activity or central pain modulation, but rather to increases in the individuals belief in their own capability of reducing EMG levels. Thus, if cognitive mechanisms are involved, an important part of relaxation treatment would be to give the adolescents a sense of control over their headache by further stressing those factors in treatment.

The complexity of coping strategies and their relationship with the outcome of relaxation is far from understood. More knowledge is needed concerning various aspects of relaxation treatment . Finally, the questions of who responds to relaxation, and who should administer it and in which setting it should be performed should be addressed in future research.

Future implications and directions

The results from several treatment studies show consistent evidence supporting the efficacy of relaxation treatment for adolescents with recurrent headaches (Eccleston et al., 2002; Holden et al., 1999). The present findings add to the results of these studies. Future studies should evaluate cost-effective treatments such as relaxation administered at school in a group format. Such research should also focus on evaluation of treatment outcomes in addition to psychological symptoms for different headache types such as migraine and tension-type headache, and also include assessment of other common somatic complaints among children and adolescents. Outcomes of various coping strategies used in connection to recurrent headaches are important areas to be addressed in future investigations. Finally, a broader

perspective including biological, psychological and social moderating factors is essential for getting a more comprehensive picture of the complex mechanisms accounting for recurrent headache.

ACKNOWLEDGEMENT

To perform a doctoral thesis is a hard work lasting for many years including several ups and downs during the process. Especially during the hard times it could not have been easy to be a husband, supervisor, co-worker or friend. So, to all the people that have been by my side, helped me, listened to my troubles, and just given me a laugh now and then I would like to express my honest gratitude:

First of all, *the Adolescents* with and without headache who participated in the studies. These studies would not have been possible without you. I really hope that research in this area continues until much more can be done to help you.

The *school nurses* who with great interest participated as administrators in Study IV. Thank you for all your dedicated work.

Bo Larsson, my supervisor. Dedicated for headache and always on the go. I thank you for sharing your vast scientific knowledge with me and for always reading my works. I also thank for generously giving me so many articles about headache. Thank you also for all laughs about serious as well as less serious things.

Per Lindberg, my other supervisor. First of all I thank you for sharing your great scientific knowledge with me. I also thank you for your always fresh eyes leading to new ideas that put things in a different light. Thirdly, I thank you for being such a diplomatic and patient person with my outbursts of anguish once in a while.

Per-Olov Sjöden, the head of the department. My greatest thanks for giving me the opportunity to learn about science and research and being part of the department. Also, I am grateful for your device: freedom under responsibility, which has helped to combine work and family. Despite the red light on your door it has always been possible to get a small chat and comment when there is need for it, which I also greatly appreciate.

Katarina Lunnner, One of the persons I have a lot of confidence in. Thanks for being such a nice and generous person. Thanks for all chats about serious as well as less serious things we have had during the years. My best luck for your future!

Anne Söderlund, The physiotherapist next door which I also have a lot of confidence in. Thanks for being such a positive and encouraging person, for all inspiring chats especially about research and life, but also about “dance, trix and clothes”...

Pernilla Åsenlöf-Fors, The other physiotherapist at the other next door. Thanks for being a so nice and enthusiastic co-worker and for nice talks about science and family life over the years.

Klara Halvarsson, Thanks for all nice chats we have had through the years. I miss you as my “neighbour”

To all other fellows at my department, for support and interesting discussions about science, and life over the years. A special thank to Marianne C. who has taken her time to read the almost ready thesis, and answered the questions I sometimes have had.

To the administrative staff at the department, Maj-Britt and Rose-Marie, thank you for administrative support during the years.

Berit Scott, at the department of Psychology who lay the ground for my interest to do research. Your great enthusiasm about research was so contagious. I thank you for that.

Katarina Laurell, new friend in the headache research. Thanks for nice lunches and “feminisitic” chats we have had. Our view of headache is quite disparate... what a team we would make if we could get the two sides together.

Lotta Jansson, my fellow gym instructor. Thank you for introducing me to a distraction to my work, it has been good relaxation to get something else to think, do and talk about.

Hans Lindeberg, at Glaxo Smith Kline for giving me the opportunity to attend their headache course in Visby which was very interesting.

To all other friends, old and new, close and more distant, Jenny & Björn, Anna & Per-Åke, Marie & Lelle, Camilla & Magnus, Charlotta M, Åsa, Pia, Lena, Stina, Tessian, Åsa & Peter, Anne. To have someone to socialize with, sharing good and bad things with and to get something other than headache to think of is invaluable. I really do appreciate you being part of my life.

My parents in law, Ulla and Hans, Always with a smile. Thanks for being so nice and helpful through all years. I am so grateful for all Wednesdays and help during the years. A special thank for all delicious food and bakeries you always bring. Your presence is absolutely invaluable.

My parents Carl and Inger Thank you for always believing in me, for giving me the opportunity to grow as a person and for all support through the years. The interest for Caring and the human being was probably set early partly by your professions. Mum, your eager to find new experiences taught me to find out more about things, to be independent, and to not give in, things I have needed during this time. Dad, your empathy, patience and eager to analyse things twice have helped me many times. Thanks for being my parents. Your presence is invaluable.

Eva, my dear sister As a four year older sister you showed me things and surroundings that encouraged my eager to learn more about life, sometimes good sometimes bad. I really do appreciate your presence and generosity during all the years. A special thank for drawing the very nice front picture.

Peter, my beloved, Thank you for being the GREATEST and closest support of all. Knowing more about me than anybody else but still there. Your generosity, warmth and energy always surrounding our family. To always believe in me and always have one more side of the coin to turn to has been an enormous support during the years. Always there to help out whatever the problem is. There are no words for this gratitude and love... You are marvellous!!!

Hanna, David and Fanny, My kids, Last, but most important. You are the best! Thank you for all the laughs and smart comments you have given through the years which have inspired my thinking. Every day something new... “Mamma, Watch out a beaver might come and grab you...” I promise I will always keep my eyes open...

REFERENCES

- Abu-Arefeh, I., & Russell, G. (1994). Prevalence of headache and migraine in schoolchildren. British Medical Journal, 309, 765-769.
- Andrasik, F., & Holroyd, K. A. (1983). Specific and nonspecific effects in the biofeedback treatment of tension headache: A 3-year follow-up. Journal of Consulting and Clinical Psychology, 51(4), 634-636.
- Andrasik, F., Kabela, E., Quinn, S., Attanasio, V., Blanchard, E. B., & Rosenblum, E. L. (1988). Psychological functioning of children who have recurrent migraine. Pain, 34, 43-52.
- Andrasik, F., Larsson, B., & Grazi, L. (2002). Biofeedback treatment of recurrent headaches in children and adolescents. In V. Guidetti & G. Russell & M. Sillanpää & P. Winner (Eds.), Headache and Migraine in Childhood and Adolescence. London: Martin Dunitz Ltd.
- Bandell-Hoekstra, E. N., Abu-Saad, H. H., Passchier, J., Fredericks, C. M., Feron, F. J., & Knipschild, P. (2001). Prevalence and characteristics of headache in Dutch schoolchildren. European Journal of Pain, 5(2), 145-153.
- Bendtsen, L., (2000). Central sensitization in tension-type headache-possible pathophysiological mechanisms, Copenhagen university, Copenhagen: thesis
- Bener, A., Uduman, S. A., Quassimi, E. M. A., Khalaily, G., Sztriha, L., Kilpelainen, H., & Obineche, E. (2000). Genetic and environmental factors associated with migraine in schoolchildren. Headache, 40, 152-157.
- Bernstein, D. A., & Borkovec, T. D. (1973). Progressive Relaxation Training: A manual for the helping professions. Illinois: Resarch Press.
- Bille, B. (1962a). Migraine in School children. A study of the incidence and short-time

prognosis, and a clinical, psychological and encephalographic comparison between children with migraine and matched controls., Uppsala university, Uppsala:thesis

- Bille, B. (1962b). Migraine in schoolchildren, Acta Paediatrica Scandinavica Vol. 51(suppl.136), pp. 1-151).
- Bille, B. (1997). A 40-year follow-up of schoolchildren with migraine. Cephalalgia(17), 488-491.
- Bille, B. (1998). Migrän. In B. Bille & B. Larsson & J. Carlsson (Eds.), Migrän och spänningshuvudvärk hos barn och tonåringar. (Migraine in Migraine and tension-type headache among children and adolescents). Lund: Studentlitteratur
- Bille, B., & Larsson, B. (1998a). Allmänt om huvudvärk. In B. Bille & B. Larsson & J. Carlsson (Eds.), Migrän och spänningshuvudvärk hos barn och tonåringar. (Generally about headache in Migraine and tension-type headache among children and adolescents). Lund: Studentlitteratur.
- Bille, B., & Larsson, B. (1998b). Introduktion. In B. Bille & B. Larsson & J. Carlsson (Eds.), Migrän och spänningshuvudvärk hos barn och tonåringar. (Introduction in Migraine and tension-type headache among children and adolescents). Lund: Studentlitteratur.
- Boekaerts, M. (1996). Coping with stress in childhood and adolescence. In M. Zeidner & N. S. Endler (Eds.), Handbook of coping. Theory, research, applications. New York: John Wiley and Sons.
- Brattberg, G., & Wickman, V. (1991). Ryggont och huvudvärk vanligt bland skolelever (Back pain and headache common among school children). Läkartidningen, 88, 2155-2157.
- Brattberg, G., & Wickman, V. (1993). Longitudinell studie av skolelever. Rehabilitera tidigt

vid ryggont/huvudvärk. (Longitudinal study of school children. Rehabilitate early when backpain/headache). Läkartidningen, 90(15), 1452-1460.

Campo, J.V. and S.L. Fritsch, *Somatization in children and adolescents*. Journal of the American Academy of Child and Adolescent Psychiatry, 1994. 33(9): p. 1223-1235.

Carlsson, J., Larsson, B., & Mark, A. (1996). Psychosocial functioning in schoolchildren with recurrent headaches. Headache, 36, 77-82.

Cautela, J., & Broden, J. (1978). Relaxation. Illinois: Research Press.

Cherchi, A., & Zompto, M. D. (2001). Pharmacology. In V. Guidetti & G. Russell & M. Sillanpää & P. Winner (Eds.), Headache and Migraine in Childhood and Adolescence. London: Martin Dunitz Ltd.

Cooper, P. J., Bawden, H. N., Camfield, P. R., & Camfield, C. S. (1987). Anxiety and life events in childhood migraine. Pediatrics, 79(6), 999-1004.

Dahlöf, C. (2001a). Huvudvärk hos barn och ungdomar. In C. Dahlöf & J.-E. Hardebo & J. Carlsson (Eds.), Huvudvärk. (Headache among children and youths) Mölndal: Glaxo Smith Kline.

Dahlöf, C. (2001b). Migrän. In C. Dahlöf & J.-E. Hardebo & J. Carlsson (Eds.), Huvudvärk. (Migraine). Mölndal: Glaxo Smith Kline.

Dunn-Geier, B. J., McGrath, P. J., Rourke, B. P., Latter, J., & D'Astous, J. (1986). Adolescent chronic pain: the ability to cope. Pain(26), 23-32.

Eccleston, C., Morley, S., Williams, A., Yorke, L., & Mastroiannopoulou, K. (2002). Systematic review of randomised controlled trials of psychological therapy for chronic pain in children and adolescents, with a subset meta-analysis of pain relief. Pain, 99, 157-165.

Egermark-Eriksson, I. (1982). Prevalence of headache in Swedish schoolchildren. A

- questionnaire survey. Acta Paediatrica Scandinavica(71), 135-140.
- Egger, H. L., Angold, A., & Costello, E. J. (1998). Headaches and psychopathology in children and adolescents. Journal of the American Academy of Child and Adolescents Psychiatry, 37(9), 951-958.
- Engel, J. M., Rapoff, M. A., & Rogot Pressman, A. (1992). Long-term follow up of relaxation training for pediatric headache disorders. Headache(32), 152-156.
- Fentress, D. w., Masek, B. J., & Mehegan, J. E. (1986). Biofeedback and relaxation-response training in the treatment of pediatric migraine. Developmental Medicine & Child Neurology, 28, 139-146.
- Forman, S. (1993). Learning to relax, Coping Skills Interventions for Children and Adolscents. (First ed.). San Francisco: Jossey-Bass Education Series.
- Galli, F., & Guidetti, V. (2002). Developmental age psychology: elements for general framing of headaches. In V. Guidetti & G. Russell & M. Sillanää & P. Winner (Eds.), Headache and migraine in childhood and adolescence (pp. 445-458). London: Martin Dunitz Ltd.
- Gauthier, J. G., Ivers, H., & Carrier, S. (1996). Nonpharmacological approaches in the management of recurrent headache disorders and their comparison and combination with pharmacotherapy. Clinical Psychology Review, 16(6), 543-571.
- Gil, K. M., Thompson, R. J., Keith, B. R., Tota-Faucette, M., Noll, S., & Kinney, T. R. (1993). Sickle cell disease pain in children and adolescents: change in pain frequency and coping strategies over time. Journal of Pediatric psychology, 18, 621-637.
- Gil, K. M., Williams, D. A., Thompson, R. J., & Kinney, T. R. (1991). Sickle-cell disease in

- children and adolescents: the relation of child and parent pain coping strategies to adjustment. Journal of Pediatric Psychology(16), 643-663.
- Gil, K. M., Wilson, J. J., & Edens, J. L. (1997). The stability of pain coping strategies in young children, adolescents, and adults with sickle cell disease over an 18-month period. The Clinical Journal of Pain, 13, 110-115.
- Gladstein, J., & Holden, W. (1996). Chronic daily headache in children and adolescents: a 2-year prospective study. Headache(36), 349-351.
- Goadsby, P. J., Haregreaves, R., & Cutrer, F. M. (1997). Patofysiologi vid migrän. Merck Sharp & Dome (Sweden) AB.
- Hermann, C., Kim, M., & Blanchard, E. B. (1995). Behavioral and prophylactic pharmacological intervention studies of pediatric migraine: an exploratory meta-analysis. Pain(60), 239-256.
- Hernandez-Latorre, M. A., & Roig, M. (2000). Natural history of migraine in childhood. Cehpalgia, 20, 573-579.
- Holden, E. W., Deichmann, M. M., & Levy, J. D. (1999). Empirically supported treatments in pediatric psychology: recurrent pediatric headache. Journal of Pediatric Psychology, 24(2), 91-109.
- Holden, E. W., Rawlins, C., & Gladstein, J. (1998). Children's coping with recurrent headache. Journal of Clinical Psychology in Medical Settings, 5(2), 147-158.
- Holden, W., Gladstein, J., Trulsen, M., & Wall, B. (1994). Chronic daily headache in children and adolescents. Headache(34), 508-514.
- Holm, J. E., Lamberty, K., McSherry, W. C., & Davis, P. A. (1997). The stress response in headache sufferers: physiological and psychological reactivity. Headache(37), 221-227.
- Holroyd, K. A., Penzien, D. B., Hursey, K. G., Tobin, D. L., Rogers, L., Holm, J. E., &

- Marcile, P. J. (1984). Change mechanisms in EMG biofeedback training: Cognitive changes underlying improvements in tension Headache. Journal of Consulting and Clinical Psychology, *52*(6), 1039-1053.
- Hunfeld, J. A. M., Passchier, J., Perquin, C. W., Hazebroek-Kampschreur, A., Suijlekom-Smit, L., & van der Wouden, J. (2001). Quality of life in adolescent with chronic pain in the head and at other locations. Cephalalgia, *21*, 201-206.
- Hunfeld, J. A. M., Perquin, C. W., Bertina, W., Hazebroek-Kampschreur, A. A. J. M., Suijlekom-Smit, L. W. A., Koes, B. W., Wouden, J. C., & Passchier, J. (2002). Stability of pain parameters and pain-related quality of life in adolescents with persistent pain: a three-year follow-up. The Clinical Journal of Pain, *18*, 99-106.
- Hämäläinen, M., Hoppu, K., & Santavuori, P. (1997). Do children with migraine respond to oral sumatriptan differently from adults. Neurology, *48*, 1100-1103.
- Hämäläinen, M., Hoppu, K., Valkeila, E., & Santavuori, P. (1997). Ibuprofen or acetaminophen for the acute treatment of migraine in children: a double-blind, randomized, placebo-controlled, cross-over study. Neurology, *48*(1), 103-107.
- International Headache Society. (1988). Classification and diagnostic criteria for headache disorders, cranial, neuralgias and facial pain. Cephalalgia, *8*(suppl 7), 1-96.
- Jacobson, E. (1929). Progressive Relaxation. Chicago: Chicago University Press.
- Jensen, M., Turner, J., Romano, J., & Karoly, P. (1991). Coping with chronic pain: a critical review of the literature. Pain, *47*, 249-283.
- Jensen, R. (2001). Mechanisms of tension-type headache. Cephalalgia, *21*, 786-789.
- Karwautz, A., Wöber, C., Lang, T., Wagner-Ennsgraber, C., Vessly, C., Kienbacher, C., & Wöber-Bingöl, C. (1999). Psychosocial factors in children and adolescents with migraine and tension-type headache: a controlled study and review of the literature. Cephalalgia, *19*, 32-43.

- King, N. J., & Sharpley, C. F. (1990). Headache activity in children and adolescents. Journal of Pediatric Child Health(26), 50-54.
- Kowal, A., & Pritchard, D. (1990). Psychological characteristics of children who suffer from headache: A research note. Journal of Child Psychology and Psychiatry, 31(4), 637-649.
- Kristjansdottir, G. (1997). Prevalence of pain combinations and overall pain: a study of headache, stomach pain and back pain among school-children. Scandinavian Journal of Social Medicine, 25, 58-63.
- Kristjansdottir, G., & Wahlberg, V. (1993). Sociodemographic differences in the prevalence of self-reported headaches in Icelandic schoolchildren. Headache, 33(7), 376-380.
- Lance, J. W., & Goadsby, P. J. (1998). Mechanism and management of Headache (Sixth ed.). Oxford: Butterworth-Heineman.
- Langefeld, J. H., Koot, H. M., Loonen, M. C., Hazebroek, A. A. J. M., & Passchier, J. (1996). A quality of life instrument for adolescent with chronic headache. Cephalalgia, 16, 183-196.
- Langeveld, J. H., Koot, H. M., & Passchier, J. (1999). Do experienced stress and trait negative affectivity moderate the relationship between headache and quality of life in adolescents? Journal of Pediatric Psychology, 24(1), 1-11.
- Larsson, B. (1988). The role of psychological, health behavior and medical factors in adolescent headache. Developmental Medicine and Child Neurology, 30, 616-625.
- Larsson, B. (1995). School-based treatment of recurrent headaches in adolescents. In J. W. & L. J. Siegel (Eds.), Adolescent Health Problems. Behavioral perspectives. Chapter 12. pp248-264. New York: Guilford Publications.

- Larsson, B. (1999). Recurrent Headaches in Children and Adolescents. In P. J. McGrath & G. A. Finley (Eds.), Chronic and Recurrent Pain in Children and Adolescents, progress in Pain Research and Management (Vol. 13). Seattle: IASP.
- Larsson, B. (2002). Prognosis of recurrent headaches in childhood and adolescence. In V. Guidetti & G. Russell & M. Sillanpää & P. Winner (Eds.), Headache and Migraine in Childhood and Adolescence. London: Martin Dunitz Ltd.
- Larsson, B., & Carlsson, J. (1996). A school-based, nurse administered relaxation training for children with chronic tension-type headache. Journal of Pediatric Psychology, 21(5), 603-614.
- Larsson, B., Daleflod, B., Håkansson, L., & Melin, L. (1987). Therapist-assisted relaxation versus self-help relaxation treatment of chronic headaches in adolescents. A school-based intervention. Child Psychology Psychiatry, 28, 127-136.
- Larsson, B., & Melin, L. (1986). Chronic headaches in adolescents: treatments in a school-setting with relaxation training as compared to with information-contact and self-registration. Pain, 25, 325-336.
- Larsson, B., & Melin, L. (1988a). The psychological treatment of recurrent headache in adolescents-short term outcome and its prediction. Headache, 24, 187-194.
- Larsson, B., & Melin, L. (1988b). Relaxation training in the treatment of recurrent pediatric headache: The Uppsala Studies. Scandinavian Journal of Behavior Therapy(17), 125-137.
- Larsson, B., & Melin, L. (1989). Follow-up on behavioral treatment of recurrent headache in adolescents. Headache, 29, 249-253.
- Larsson, B., Melin, L., & Döberl, A. (1990). Recurrent tension headache in adolescents treated with self-help relaxation training and a muscle relaxant drug. Headache(30), 665-671.

- Larsson, B., & Zahlua, M. (2002). Swedish school nurses' view of school health care utilization, causes and management of recurrent headaches among school children. submitted.
- Laurell, K., Eeg-Olofson, O., & Larsson, B. (1999). Tension-type headache in children. Paper presented at the IVth International Congress on Headache in Childhood and Adolescence, Turku, Finland.
- Lazarus, R. S. (1993). Coping theory and research: Past, present, and future. Psychosomatic Medicine, *55*, 234-247.
- Lee, L. H., & Olness, K. N. (1997). Clinical and demographic characteristics of migraine in urban children. Headache, *37*, 269-276.
- Marates, J., & Wilkinson, M. (1982). Migraine in children: A medical and psychiatric study. Cephalalgia, *2*, 179-187.
- Marklund, U. (1997). Health behavior in school-aged children. A WHO collaborative study (110). Stockholm: Institute for Public Health.
- Martin-Herz, S. P., Smith, M. S., & McMahon, R. J. (1999). Psychosocial factors associated with headache in junior high school students. Journal of Pediatric Psychology, *24*(1), 13-23.
- McGrath, P. A. (2001). Headache in children: The nature of the problem. In P. A. McGrath & L. M. Hillier (Eds.), The child with headache: Diagnosis and treatment (Vol. 19). Seattle: International Association for the study of pain.
- McGrath, P. A., & Hillier, L. M. (2001). Recurrent headache: Triggers, causes and contributing factors. In P. A. McGrath & L. M. Hillier (Eds.), The child with headache: Diagnosis and treatment (Vol. 19). Seattle: International Association for the study of pain.
- McGrath, P. J., Humphreys, P., Goodman, J. T., Keene, D., Firestone, P., Jacob, P., &

- Cunningham, S. J. (1988). Relaxation prophylaxis for childhood migraine: a randomized placebo-controlled trial. Developmental Medicine and Child Neurology, *30*, 626-631.
- Metsähonkala, L. (1997). Migraine in childhood. University of Turku, Finland, Turku: thesis
- Metsähonkala, L. (2002). Tension-type headache. In V. Guidetti & G. Russell & M. Sillanpää & P. Winner (Eds.), Headache and Migraine in Childhood and Adolescence (pp. 502). London: Martin Dunitz Ltd.
- Metsähonkala, L., Sillanpää, M., & Tuominen, J. (1997). Headache diary in the diagnosis of childhood migraine. Headache, *37*, 240-244.
- Metsähonkala, L., Sillanpää, M., & Tuominen, J. (1997). Outcome of early school-age migraine. Cephalalgia, *17*(6), 662-665.
- Newacheck, P. W., & Taylor, W. R. (1992). Childhood chronic illness: Prevalence, severity and impact. American Journal of Public Health, *82*, 364-371.
- Olness, K., Mac Donald, J. T., & Uden, D. L. (1987). Comparison of self-hypnosis and propranolol in the treatment of juvenile migraine. Pediatrics, *79*, 593-597.
- Olsson, G., & Jylli, L. (Eds.). (2001). Smärta hos barn och ungdomar. (Pain among children and youths). Lund: Studentlitteratur.
- Olsson, G., & von Knorring, A.-L. (1997). Depression among Swedish adolescents measured by the self-rating scale Center for Epidemiology Studies-Depression Child (CES-DC). European Child and Adolescent Psychiatry, *6*, 81-87.
- Osterhaus, S. O. L., & Passchier, J. (1992). The optimal length of headache recording in juvenile migraine patients. Cephalalgia(12), 297-299.
- Pakalnis, A. (2001). New avenues in treatment of paediatric migraine: a review of the literature. Family Practice, *18*(1), 101-106.
- Palermo, T. M. (2000). Impact of recurrent and chronic pain on child and family daily

- functioning: a critical review of the literature. Developmental and Behavioral Pediatrics, 21, 58-69.
- Passchier, J., & Orlebeke, J. F. (1985). Headaches and stress in schoolchildren: an epidemiological study. Cephalalgia, 5(3), 167-176.
- Perquin, C. W., Hazebroek-Kampschreur, A., Hunfield, J., Bohnen, A. M., Suijlekom-Smit, L., Passchier, J., & van der Wouden, J. (2000). Pain in children and adolescents: a common experience. Pain, 87(1), 51-58.
- Raieli, V., Raimondo, D., Cammalleri, R., & Camarda, R. (1995). Migraine headache in adolescents: a student population-based study in Monreale. Cephalalgia, 15, 5-12.
- Reid, G., Dubow, E. F., & Carey, T. C. (1995). Developmental and situational differences in coping among children and adolescents with diabetes. Journal of Developmental Psychology, 16, 529-554.
- Reid, G. J., Gilbert, C. A., & Mc Grath, P. J. (1998). The Pain Coping Questionnaire: preliminary validation. Pain(76), 83-96.
- Reynolds, C. R., & Richmond, B. O. (1997). What I think and feel: A revised Measure of Children's Manifest Anxiety. Journal of Abnormal Child Psychology, 25(1), 15-20.
- Rhee, H. (2000). Prevalence and predictors of headaches in US adolescents. Headache, 40, 528-538.
- Richter, I. L., Mc Grath, P., Humphreys, P. J., Goodman, J. T., Firestone, P., & Keene, D. (1986). Cognitive and relaxation treatment of pediatric migraine. Pain(25), 195-203.
- Roberts, R. E., Lewinsohn, P. M., & Seeley, J. R. (1991). Screening for adolescent

- depression: A comparison of depression scales. Journal of the American Academy of Child and Adolescent Psychiatry(30), 58-66.
- Rokicki, L. A., Holroyd, K. A., France, C. R., Lipchick, G. L., France, J. L., & Kvaal, S. A. (1997). Change mechanisms associated with combined relaxation/EMG biofeedback training for chronic tension headache. Applied Psychophysiology and Biofeedback, 22(1), 21-41.
- Rothner, A. D. (2001). Differential diagnosis of headaches in children and adolescents. In P. A. McGrath & L. M. Hillier (Eds.), The child with headache: Diagnosis and treatment (Vol. 19). Seattle: International Association for the study of pain.
- Schneider, M. B., Friedman, S. B., & Fisher, M. (1995). Stated and unstated reasons for visiting a high school nurse's office. Journal of Adolescent Health, 16, 35-40.
- Schoenbach, V. J., Kaplan, B. H., Grimson, R. C., & Wagner, E. H. (1982). Use of a symptom scale to study the prevalence of a depressive syndrome in young adolescents. American Journal of Epidemiology(116), 791-800.
- SIFO. (1998). Migrän (Telephonesurvey 3282260). Stockholm: Sifo resarch and Consulting AB.
- Silberstein, S. D., Lipton, R. B., & Dalessio, D. J. (Eds.). (2001). Wolff's headache and other head pain (Seventh ed.). Oxford: Oxford University Press.
- Sillanpää, M. (1983a). Prevalence of headache in prepuberty. Headache, 23, 10-14.
- Sillanpää, M. (1983b). Changes in the prevalence of migraine and other headaches during the first seven school years. Headache, 23, 15-19.
- Sillanpää, M., & Antilla, P. (1996). Increasing prevalence of headache in 7-year-old schoolchildren. Headache, 36, 466-470.
- Sillanpää, M., Piekkala, P., & Kero, P. (1991). Prevalence of headache in preschool age in an

- unselected child population. Cephalalgia, 11, 239-242.
- Stang, P. E., & Osterhaus, J. T. (1993). Impact of migraine in the United States: data from the National Health Interview Survey. Headache, 33, 29-36.
- Thastum, M., Zachariae, R., & Herlin, T. (1998). A Danish adaptation of the Pain Coping Questionnaire for children: preliminary data concerning reliability and validity. Acta Paediatrica(88), 132-138.
- Vahlqvist, B. (1955). Migraine in children. International Archives of Allergy, 7, 348-355.
- Van den Brink, M., Bandell-Hoekstra, E. N., & Abu-Saad, H. H. (2001). The occurrence of recall bias in pediatric headache: a comparison of questionnaire and diary data. Headache, 41(1), 11-20.
- Van der Bree, M. B. M., Passchier, J., & Emmem, H. H. (1989). Influence of quality of life and stress coping behavior on headaches in adolescent male students: an explorative study. Headache, 30, 165-168.
- Varni, J. W., Waldron, S. A., Gragg, R. A., Rapoff, M. A., Bernstein, B. H., Lindsley, C. B., & Newcomb, M. B. (1996). Development of the Waldron/Varni Pediatric Pain Coping Inventory. Pain, 67, 141-150.
- Walker, L. S., & Greene, J. W. (1991). The functional disability inventory: measuring a neglected dimension of child health status. Journal of Pediatric Psychology, 16(1), 39-58.
- Walker, L. S., & Zeeman, J. L. (1992). Parental response to child illness behavior. Journal of Pediatric Psychology, 17(1), 49-71.
- Weisman, M. M., Sholomskas, D., Pottenger, M., Prusoff, B. A., & Locke, B. Z. (1977). Assessing depressive symptoms in five psychiatric populations: a validation study. American Journal of Epidemiology(106), 203-204.
- Wennerstrand, A. (2002, August 19th). Skolsköterskor går på knäna. Ungefär 800 barn på

varje sköterska. Förebyggande vård försummas. (School nurses are walking on the knees. Approximately 800 children on every nurse. Preventive care is neglected). Uppsala Nya Tidning.

Winner, P., Lewis, D., Visser, H., Jiang, K., Ahrens, S., & Evans, J. K. (2001). Rizatriptan 5 mg for the acute treatment of migraine in adolescents: A randomized, double-blind, placebo-controlled study. Headache, 42, 49-55.

Wolff, H. G. (1955). Headache and other Head pain. International Archives of Allergy, 7, 210.

Wolpe, J., & Lazarus, A. A. (1966). Behavior Therapy Techniques. A guide to treatment of neuroses. New York: Pergamon Press.

Wännman, A. & Agerberg.(1987). Recurrent headaches and craniomandibular disorders in adolescents: a longitudinal study. Journal of Craniomandibular Disease and Facial pain,1, (227-236).

Zeidner, M., & Endler, N. S. (1996). Coping and defense a historical overview. In M. Zeidner & N. S. Endler (Eds.), Handbook of Coping : Theory, Research, Applications. New York: John, Wiley & Sons.