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A REVIEW OF PROGRESSIVE MUSCLE RELAXATION INTERVENTIONS USED WITH SCHOOL-AGED CHILDREN AND ADOLESCENTS

by

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of the requirements for the degree

of

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CONTENTS

ABSTRACT

A Review of Progressive Muscle Relaxation Interventions

used with School-Aged Children and Adolescents

by

Christopher Laypath, Master's of Science

Utah State University, 2001

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Department: Psychology

Progressive muscle relaxation (PMR) techniques have been used since the early twentieth century as a means of inducing relaxation and decreasing muscle tension. However, only in the last twenty five years have systematic studies of these techniques to treat children and adolescents appeared with any regularity in the research literature.

The last major review of the literature was published in 1989. The purpose of this paper was to examine studies published since the last review of the literature. A special emphasis was placed on studies set in schools or that were relevant to mental health professionals in those settings. The bulk of this paper was devoted to examining how PMR has been used in the last decade to treat problems and disorders such as: anxiety, depression, asthma, headaches, attention deficit hyperactivity disorder, juvenile rheumatoid arthritis, and tourette syndrome. It was found that PMR was most effective in reducing somatic symptoms of anxiety and headache symptomatology but that more research must be conducted before the overall efficacy of PMR with childhood

populations can be determined. This paper concludes with a discussion of how the current findings can be used by school-based mental health practitioners.

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To my family and friends who have put up with me with the last few months. Thank you. You are all very special to me

Christopher A. Laypath

Introduction/Problem Statement

Many problems that can have a negative effect on the academic performance of children and adolescents such as hyperactivity, anxiety, behavior problems, and headaches are either the result of, or exacerbated by, internal and/or external stressors in their lives. Intuitively, it would make sense that the best method of ameliorating the impact of these problems upon children would be to eliminate these stressors. Unfortunately, known childhood stressors such as poverty, difficulty with peers, inconsistent parenting, and general medical problems are often difficult to change and not always practical to address by school-based mental health professionals. However, the development of coping skills to better handle these stressful situations is something that can be addressed by professionals in school-based settings. In addition, internal stressors (e.g., headaches and physical symptoms of anxiety) may also affect children's academic functioning. Relaxation training procedures may be an effective method of teaching a child methods of coping with external and internal stressors as well as significantly reducing the negative impact upon the child (Richter, 1984).

Contemporary relaxation training procedures were originally developed by Edmund Jacobson (1938) and have been used as a component of systematic desensitization, biofeedback, and cognitive-behavioral interventions. Relaxation procedures have also been used by themselves to treat a plethora of potentially school-related problems such as pediatric migraine headaches, conduct problems, and anxiety (Forman, 1993).

Jacobson, a physiologist at Harvard University, believed that muscle tension could

be removed through tensing and relaxing muscle groups in the body. Jacobson began his work in 1908 and continued to contribute to the research base regarding relaxation well into the 1960s (Bernstein, Borkovec, & Hazlett-Stevens, 2000). Jacobson was a prolific scientist who also invented the technique of quantitative EMG recording which is a method of measuring electrical activity of the muscles of the body and he is considered one of the fathers of psychosomatic medicine (Lehrer, 1982).

The method of relaxation developed by Jacobson is currently one of the most widely used relaxation techniques with children and adolescents and is called progressive muscle relaxation (PMR). In essence, PMR training consists of learning to successively tense and then relax several groups of muscles all throughout the body while at the same time paying close attention to the feelings associated with both tension and relaxation (Bernstein et al., 2000). PMR techniques have been used in research studies for over 50 years, yet there are still many questions regarding their efficacy. Relaxation training procedures were originally designed to be used with adults and it is only in the last 20 years that systematic studies of these techniques with children and adolescents appeared with any regularity in the literature (Richter, 1984). In addition, there has been a paucity of studies, especially controlled studies, addressing the efficacy of school-based interventions based on the principles of PMR (King, Ollendick, Murphy, and Molloy, 1998). King and his colleagues remark that the school-based interventions involving PMR that have been conducted have shown only modest improvements and are of dubious educational significance and therefore goals for programs incorporating these interventions in school settings should be modest (King et al, 1998). Some areas for

further investigation in the field of PMR techniques as they apply to children and adolescents include identifying personal characteristics such as age that may affect the efficacy of PMR; determining which disorders or conditions respond the best to PMR; and answering the question of how PMR fares when directly compared to other treatment modalities. These issues and questions will be addressed and discussed in this review of the literature.

General Background

Use of PMR with children

Progressive muscle relaxation has been used to treat a variety of medical and psychological problems. The eclectic list of problems may not appear to have very much in common but every one of them can have a negative effect on a child or adolescent's academic performance in school. Sometimes, such as with test anxiety, the negative impact on school performance is caused by the disorder. Other times as with conditions like asthma or recurrent headaches the negative impact may be more indirect such as contributing to the amount of school missed because of the medical condition. Regardless of the etiology of a disease or disorder, if it affects the child's school performance either directly or indirectly, the school psychologist should be involved in both assessing the problem and developing and implementing appropriate school-based interventions. In the last 10 years, studies of PMR with children and/or adolescents have evaluated its success in treating anxiety (both generalized and test anxiety), Attention- Deficit/Hyperactivity Disorder (ADHD), asthma, arthritis, depression, recurrent headaches, and Tourette's

syndrome.

Physiological effects of PMR

It is unclear exactly how tensing and releasing specific muscle groups relieves symptoms of anxiety and somatic complaints. The underlying idea behind PMR is that physiological arousal or tension plays a major role in the development or maintenance of many disorders including headaches and anxiety (King et al., 1998). Jacobson (1938) defined relaxation as the quiescence of skeletal muscle activity, as measured peripherally by EMG. Later researchers such as Benson, Beary, and Carol (1974) emphasized parasympathetic activity in the autonomic nervous system rather than the muscular aspects of relaxation. These researchers believe that all relaxation techniques have the same effect on parasympathetic activity. These theories have not held up as well to empirical validation as has Jacobson's muscular theory (Poppen, 1988). Other researchers believe that the type of relaxation technique used should depend on the specific symptoms of the client. It has been proposed that cognitive symptoms of stress might be better treated by cognitive-based interventions while somatic methods such as PMR would be better suited for somatic anxiety (Heide & Borkovec, 1983). In support of this argument, Lehrer (1982) cites research that has found that people who practice meditation report fewer cognitive symptoms but more somatic symptoms than people who engage in PMR. More recent support for this claim is found in the research of Eisen and Silverman (1993, 1998) which will be discussed later in regard to the efficacy of PMR in the treatment of anxiety.

It should also be noted that while physiological measures of relaxation have

remained fairly consistent over the years (i.e., EMG, heart rate, blood pressure, electrodermal activity, skin temperature, and oxygen uptake) there has been no consistent evidence that these measures are either necessary or sufficient to measure relaxation (Poppen, 1988). A fairly new theory is that at least in part, PMR works by stimulating the release of endogenous opioids. A recent study put this theory to the test. First the researchers taught their adult subjects PMR and had them use it while performing a mental arithmetic task. They found that PMR significantly reduced these subjects' diastolic blood pressure. Next, the researchers blocked opioid receptors of the subjects by using the opioid antagonist, naltrexone. They found that this drug antagonized the effects of relaxation training which suggest that some of the physiological effects of relaxation training are mediated by augmentation of inhibitory opioid mechanisms (McCubbin et al., 1996). While research concerning relaxation training functioning as an opioid agonist is an exciting new area of research it should be kept in mind that the results of this study have not been replicated. Currently, the specifics of how PMR works to reduce anxiety and somatic symtomatology are unresolved.

Mode of Delivery

Over the last two decades there has been some debate over the best method of delivering a PMR-based intervention to children and adolescents. The two primary dichotomies regarding this issue are individual versus group training and live versus tape-recorded training. Group training and audio tape-recorded progressive relaxation training are attractive from a cost efficiency view-point but there is some empirical support for the notion that individual training and live training are the most effective methods for

delivering PMR training as a psychological intervention.

It does appear that tape-recorded training is not as effective as a relaxation technique presented live by a trainer, especially when the effects of relaxation are measured at a session other than training sessions (Lehrer,1982). A study that possibly supports this conclusion as it pertains to children compared a Jacobsonian-type relaxation tape with a control tape featuring an adventure story in reducing the muscle tension of hyperactive boys. They found a significant drop in muscle tension for both groups with no significant difference between the groups (Putre, Loffio, Chorost, Marx, & Gilbert, 1974).

There could be many reasons for these findings and it should be noted that muscle tension was only measured directly after sessions but the authors of the study suggest that there may have been a difference between the treatment group and the control group if the PMR intervention was administered live. They feel that because there is more of an opportunity for individual pacing and for the client to ask questions when PMR is presented live that PMR instruction delivered via tape is inferior to this technique being administered by a live person. However, this is conjecture because the authors did not actually test this hypothesis. A review of the literature (Carlson & Hoyle, 1993) that also supports the notion of live training of PMR being superior to training via audiotape will be discussed in a later section.

Group relaxation training in school-based settings is enticing not only because of the cost efficiency of this intervention but because teachers or professionals in the school other than psychologists or counselors could be trained to administer the technique to groups of students and because of the potential of peer support for the children in the

group (King et al., 1998). Several studies (e.g., Richter, 1984; Chang & Hiebert, 1989) have found positive treatment effects for PMR administered in a group format. However, Carlson and Hoyle (1993), in the only meta-analysis located concerning the effects of PMR as a behavioral medicine treatment approach, found that studies in which subjects were trained individually obtained stronger effects than those in which subjects were trained in groups.

Some clinicians have also used PMR in combination with music. The efficacy of this combination has not been examined with children or adolescents but Robb (2000) compared music assisted PMR with PMR alone and music alone in reducing anxiety in adults. She found that all conditions produced significant changes in anxiety and perceived relaxation but that music assisted PMR produced the greatest amount of change. This suggests that combining relaxation treatments may make the intervention more effective. A possible support for this argument comes from some of the earlier studies of PMR with elementary-school children that combined adult praise and reinforcement with PMR and obtained positive effects (e.g., Loffredo, Omizo, & Hammett, 1984; Zaichkowsky & Zaichkowsky, 1984). However, it should be kept in mind that these studies did not test PMR against reinforcement alone so only tentative conclusions can be drawn. It does seem logical that combining PMR with other relaxation techniques or with behavioral contingencies could increase the positive effects of PMR. However, this is still an area that requires further exploration.

The appropriate number of sessions of PMR necessary to obtain optimal treatment effects is another unresolved issue. Bernstein and Borkovec (1973) recommend 10

sessions but studies, even those studies purporting to use Bernstein and Borkovec's treatment manual, vary widely in the number of sessions used. In a meta-analysis of Bernstein and Borkovec based PMR, Carlson and Hoyle (1993) found that the magnitude of effect size was positively associated with the number of training sessions and the number of weeks which training took place.

Treatment Acceptability/Compliance

Treatment acceptability is an important concept to keep in mind when developing interventions. If a person receiving psychological treatment does not believe the intervention is likely to be effective, he or she is less likely to attain beneficial results since he or she is less likely to carry out the treatment (Reimers, Wacker, Cooper, & De Raad, 1992). Treatment acceptability becomes even more important with a psychological intervention that is to be implemented in the schools with a child or adolescent in a situation that will require the parents of that child or adolescent to give their consent for treatment. In most cases school-based interventions also require, or at least benefit by, support from the child's teacher. King and Gullone (1990) surveyed 193 students ages 13 to 17 , 64 parents, and 77 secondary school teachers regarding their acceptability of 7 widely used psychological treatment procedures to reduce fears. In general, all of the treatments were approved of by the respondents. Progressive muscle relaxation was rated the third most acceptable treatment behind systematic desensitization (which commonly includes a PMR component) and modeling. This hierarchy remained the same when these respondents were asked to rank the treatments in order of perceived effectiveness (King & Gullone, 1990). No studies were located assessing the treatment acceptability of using

PMR with elementary school students but the above study indicates that PMR may be an acceptable intervention to both the parents and teachers of secondary school students.

Although students, parents, and teachers may find PMR acceptable, there are some research studies that indicate compliance with PMR may be lower than with other forms of relaxation training. A study with adults compared PMR to music therapy in the treatment of asthma. The group treated with music therapy had a higher rate of compliance to treatment than the PMR group (Lehrer et al., 1994). One possible reason for low compliance with these procedures is suggested by Smith and colleagues (1996). These researchers propose that PMR works primarily through negative reinforcement. That is, the focus of these techniques is on removing tension and worry. Positive reinforcement from PMR is often indirect and delayed in the form of improvements in health, productivity, and well-being. They suggest that these are relatively weak reinforcers and that PMR can become a mechanical health chore (Smith, Amutio, Anderson, & Aria, 1996).

Another study with adults comparing meditation to PMR found that people enjoyed meditation more than PMR, practiced it more, and reported being more involved in the technique (Lehrer, Woolfolk, Rooney, McCann, & Carrington, 1983). Perhaps compliance with PMR can be improved in older children and adolescents by associating the relaxation activities with techniques that are more reinforcing such as listening to music or meditation. Younger children may initially need more extrinsic reinforcement paired with PMR that would eventually be faded as the techniques themselves become reinforcing. Combining positive reinforcement techniques with the already present

negative reinforcing component of PMR is something that has not been examined thoroughly and is an area where further research is necessary.

Assessing the effectiveness of PMR

Poppen (1988) believes that a big problem with the majority of outcome research regarding PMR procedures is that researchers and clinicians rarely attempt to assess whether or not their participants actually learn the skill of PMR. Without assessment of the participant's performance it is impossible to accurately reinforce progress, remediate errors, and move to the next stage of training. Most researchers use PMR as an intermediate step between treatment and outcome. For example a researcher may teach PMR to a group of children experiencing symptoms of anxiety and if the symptoms decrease compared to the symptoms of a matched control group the researcher can demonstrate that the outcome is statistically more probable with PMR than with whatever placebo condition was used in the control group. However, according to Poppen (1988), the obtained results do not offer much clinical usefulness. Using a medication analogy, Poppen claims that studies of this kind are similar to examining whether or not the prescription of a medication is related to outcome rather than examining the relationship between the physiological action of the medication and outcome. The provision of treatment is not the same thing as the client actually acquiring the skill of PMR and employing it in settings other than those in which he or she learned the skill. Poppen (1988) asserts that only by assessing the client's proficiency in PMR can it become possible to determine a dose-response relation which is a powerful measure of treatment effectiveness.

Three types of measures can be used to assess the effectiveness of PMR procedures with children: subjective, physiological, and overt-behavioral (King et al., 1998). Subjective assessment consists of the child being asked to report his or her arousal level on a rating scale. Physiological assessment commonly includes such measures as heart rate, EMG, and skin temperature. Overt-behavioral assessment is conducted through a systematic assessment of the child's relaxation skills. Only one standardized overt-behavioral assessment measure, the Behavioral Relaxation Scale (Poppen, 1988), was located. This scale was designed to assist in the systematic observation and recording of relaxed and unrelaxed behaviors for the major muscle groups involved in PMR. However, while this measure may one day prove to be a useful tool for assessing the degree to which a client has learned and is using PMR, currently there is a paucity of studies examining its reliability and validity (King et al., 1998). One recent research study does support the validity of the BRS with adults. Of three psychological measures, three physiological measures, and the BRS, only the BRS could reliably distinguish a group of undergraduate university students who had been trained in PMR from a group of students who had just been told to relax (Norton, Holm, & McSherry, 1997). The use of such a systematic behavioral assessment system could be particularly useful in a school-based setting where physiological measures such as EMG may be cost-prohibitive or impractical to use.

Jacobsonian vs. Abbreviated PMR

One potential problem with true Jacobsonian PMR is that it is quite time intensive. According to Bernstein and colleagues (2000) the typical training program lasted 56

sessions, and could last as long as 200 sessions. Each session was focused on one of approximately 44 muscle groups and could last longer than an hour (Lehrer, 1982).

An abbreviated version of Jacobson's PMR techniques was first developed by Wolpe (1958) as a component in his systematic desensitization treatments. Bernstein and Borkovec (1973) published a treatment manual that presented a standardized version of PMR based on the techniques developed by Jacobson but more closely resembling the abbreviated format used by Wolpe. The development of a standardized manner of implementing PMR training was invaluable to researchers assessing the effectiveness of these procedures. Many times researchers interested in studying these techniques develop their own manuals. Unfortunately, the majority of time these researchers do not sufficiently detail the procedures used. This lack of specificity can limit the value and meaning of the results of their research because future researchers and clinicians cannot accurately replicate their procedures (Bernstein et al., 2000). Bernstein and Borkovec's modification of Jacobson's procedures is useful to researchers and clinicians because it is more time-efficient and the procedures are clearly outlined in such a way that their method of PMR can be duplicated and examined by others interested in assessing its effectiveness. In fact, Bernstein and Borkovec's PMR treatment manual has been used in many research studies and has been the subject of at least two literature reviews (Carlson & Hoyle, 1993; King, 1980). The abbreviated format Bernstein and Borkovec developed focuses on only 16 different muscle groups and uses suggestion to induce relaxation by focusing on the contrasts between the contraction of muscle groups and the subsequent release. Unlike clinicians who use abbreviated procedures, Jacobson taught the technique purely as a

muscular skill and spoke in a neutral tone in an attempt to avoid the suggestion that is inherent when using a slower, deeper voice (Lehrer, 1982). Jacobson actively attempted to avoid suggestion in training sessions. He believed that suggestion prevented the subject from learning the actual motor skill and encouraged the subject to feel relaxed during a training session, even if levels of physiological arousal are not lowered. In contrast, abbreviated PMR techniques focus heavily on the contrasts between muscle tension and release. When subjects are told to relax the clinician will often speak in a softer, deeper, slower voice, in order to enhance suggestion (Lehrer, 1982). Poppen (1988) believes that this is a type of "placebo-effect" wherein the subject's feelings are cued by the clinician's behavior and that positive effects of this kind of PMR training may possibly only be seen in the presence of the trainer and would not generalize to other settings. At least one researcher (Lehrer, 1982) believes that abbreviated PMR which is virtually the only form of PMR used in research studies and clinical practice currently is better suited for "psychological" problems such as anxiety and that both researchers and practitioners should consider returning to "pure" Jacobsonian PMR to treat "somatic" problems like headaches or asthma. However, at present, this recommendation is not supported by research.

Inclusion/Exclusion Criteria for Current Review

Two comprehensive reviews of the efficacy of relaxation techniques with children and adolescents were located (Chang & Hiebert, 1989 ; Richter, 1984) and their findings will be summarized. Because these reviews thoroughly document the use of PMR as it

was used to treat children and adolescents with a variety of disorders and conditions prior to 1989, only studies published 1989-February, 2000 were examined in depth for this current review of the literature. In addition to those two comprehensive reviews, a review published by Carlson and Hoyle (1993)was located that looked specifically at the efficacy of the procedural manual designed by Bernstein and Borkovec (1973). This review only looked at medical disorders and pertained to adults as well as to children and adolescents. Therefore, the studies in that review published in 1989 or later that pertain to children will be discussed in-depth in the current review and aspects relevant to adult studies and those with children that were published prior to 1989 will be discussed anecdotally. Other studies found relevant to the current status of the efficacy of PMR with children and adolescents that were published prior to 1989 or that deal with the efficacy of PMR in the treatment of adults will also be mentioned anecdotally.

To be included in the current review, studies had to specifically indicate that PMR was used either by itself or in combination with other relaxation procedures (e.g., imagery, deep-breathing). Only PMR based relaxation treatment that would be feasible to implement in most school-based settings were included. Therefore, studies that combined PMR with biofeedback were omitted from the current review since most school-based practitioners do not have access to biofeedback equipment. Many research studies examine PMR indirectly as a component of a more comprehensive intervention (e.g., systematic desensitization, cognitive-behavioral therapy). Because there is no way of knowing how effective each component of a treatment is in a study that looks only at the results of a combined treatment package and because more comprehensive interventions

include components other than relaxation techniques, these studies were not included in the current review unless the effectiveness of a comprehensive treatment package was directly compared to that of PMR. Age of subjects was another criterion used to determine inclusion/exclusion. Only studies that presented data showing the results of PMR with children and/or adolescents 18 or under were examined.

A computer search of Psyclit, ERIC, and Medline was undertaken to identify relevant research articles. The following key words were used in this search: progressive relaxation, relaxation training, relaxation, and muscle relaxation. Abstracts were then manually examined and those pertaining to children and/or adolescents were selected for further review. In addition, bibliographies of primary sources were also examined for additional sources. Only published studies were included in this review.

Previous Reviews

In the meta-analysis conducted by Carlson and Hoyle (1993), studies published from 1981 to 1992 that used the abbreviated progressive muscle relaxation training format standardized by Bernstein and Borkovec (1973) were reviewed and analyzed. This was the only review of the literature found concerning PMR that had such a narrow focus. The studies included were limited to those that used the procedures described by Bernstein and Borkovec and those that only used PMR with no combined treatment. Twenty-nine studies were found that met this criteria, with PMR being used to treat disorders ranging from tinnitus to menopausal hot flashes. Although a wide range of effect sizes were discovered, overall, it was found that this version of PMR was an effective treatment for

the disorders located for their sample. One of Carson and Hoyle's more interesting findings was that the studies that used PMR to treat headache pain had the largest effect sizes. As mentioned in an earlier section, it was also found that studies in which subjects were trained individually had obtained larger effect sizes than those studies in which subjects were trained in groups and that when subjects were given practice tapes to augment in session training effect sizes were larger. In studies that included both physiological and psychological outcome variables, larger effect sizes were found for psychological outcomes. These researchers also found that the effectiveness of PMR improves with the number of sessions and the number of weeks over which sessions were scheduled. However, this only remained true up to 12 sessions taking place over a 12 week period. Effect sizes leveled off at this point. Therefore, Carlson and Hoyle (1993) conclude that based on the current research, 12 sessions is likely the most efficacious length of treatment. Although Carlson and Hoyle did include studies where the sample included children and adolescents, they did not examine whether or not age was related to outcome. In addition, the great majority of the studies included in their review only used adult subjects. Therefore, caution should be exercised when generalizing these results to childhood populations.

Two literature reviews examining the efficacy of relaxation training with children and adolescents as a treatment for a variety of problems were located. The overall findings of these two reviews will be discussed here. The aspects of the reviews that concern specific disorders will be covered in later sections of this paper.

Richter (1984) included 26 studies of relaxation training with children. His focus

was primarily on populations of children that could benefit from PMR in a school-based setting. He found studies pertaining to a wide range of presenting problems including: poor handwriting, behavioral problems, test anxiety, generalized anxiety, asthma, insomnia, autism, headaches, and seizures. Richter (1984) summarized the body of literature up to 1984 by noting that further consideration concerning relaxation procedures with children is warranted considering the generally positive results found. Richter found that relaxation training has been effective when implemented over an extended period of time and accompanied by additional supports, such as educational training in which children are taught how and when to use relaxation techniques outside of the training setting. In addition, it was discovered that when problems and behaviors were operationally defined and appropriate and meaningful dependent measures were used, that relaxation training has been effective following shorter lengths of training. In his review, Richter notes that relaxation training has often been found to be as effective as other psychological interventions (e.g., biofeedback and various counseling techniques). He also suggests that relaxation training in a school-setting may be a cost-effective approach for a variety of presenting problems and that its utility in this setting is worth future consideration. Some of the methodological problems that were found in child/adolescent studies of PMR included: a myriad of dependent measures with a questionable correlation between them, lack of follow-up measures, the brevity of the treatment, and an overinclusive diagnostic criteria within a subject population.

Richter concluded that research supports the notion that PMR is most effective when used over an extended period of time and augmented by some kind of supportive

and/or educational training. He also found that the effectiveness of PMR is doubtful from a clinical standpoint when used as an isolated treatment for enduring or vaguely defined problems such as conduct problems or school attitudes. Due to the lack of long-term studies, Richter concludes that effects of PMR over time are unclear. He also indicates that knowledge concerning the minium age limit for the effective use of PMR is lacking as is information regarding interactions between response to treatment and use of medication. Richter finishes by saying, "At this point we do not know how effective relaxation training is by itself" (p. 341).

In 1989 Chang and Hiebert published a general review of relaxation procedures with children. The presenting problems they examined were similar to those looked at by Richter (1984) and included: test anxiety, behavior problems, hyperactivity, academic problems, and general anxiety. Chang and Hiebert (1989) included a lengthy section of the efficacy of PMR with this population and conclude that the effects of PMR are facilitated when training occurs within a specific context. They also say that just exposing children and/or adolescents to training on tape is ineffective but if instruction is provided with a lucid, age-appropriate rationale it may be beneficial. Chang and Hiebert assert that when using PMR with children, specific performance criteria should be stipulated and that data collection methods should include ways to ascertain the degree to which children are following the training program. They also concur with Richter (1984) that the support of adults is essential in the success of PMR with school-aged children and that age-appropriate language should be used.

Some methodological problems with the research on PMR up to 1989 that Chang

and Hiebert point out are that most studies lacked adequate controls (e.g, placebo controls) and that the treatments used are confounded and unspecific. They also agree with Richter (1984) that more attention needs to be given by researchers to the area of assessing skill acquisition.

Chang and Hiebert (1989) and Richter (1984) both stress the importance of only using PMR to treat appropriate problems, namely, those problems related to stress, tension, or anxiety. Both of these reviews stated that there was no support for using these procedures to treat vaguely defined problems such as delinquency or poor school attitudes. However, their overall conclusions were that making a general statement regarding the efficacy of PMR with children is difficult because the majority of studies do not report the degree to which subjects receiving training actually acquired the ability to relax, or how closely the children adhered to treatment procedures.

In the years since the reviews by Richter (1984) and Chang and Hiebert (1989) were published researchers have mostly abandoned examining the effects of PMR on such problems as poor handwriting and general conduct problems. In addition, in recent years, problems such as depression and Tourette's Syndrome in children and/or adolescents have received more attention by researchers and PMR is one of the techniques that has been studied since 1988 to treat these problems. In the following sections, studies using PMR with children and/or adolescents published in 1989 or later will be discussed. Internalizing disorders will be discussed first beginning with anxiety (both test and general) and then depression. Next, PMR as it has been used to treat the symptoms of asthma and recurrent headaches will be examined. Attention-Deficit/Hyperactivity Disorder will be discussed

next followed by disorders where only one study was located regarding the efficacy of PMR (i.e., Juvenile Rheumatoid Arthritis and Tourette Syndrome). Appendix 1 provides a detailed description of each of the studies described below.

Anxiety

Test anxiety

Dusek (1980) defines test anxiety as an "unpleasant feeling or emotional state that has physiological and behavioral concomitants and that is experienced in formal testing or other evaluative situations. When test anxiety is experienced, a variety of cognitive and attentional processes are called into play that interfere with effective and successful test performance" (p. 88). Test anxiety occurs quite frequently. Prevalence ranges from 10 to 30% of the school population with at least 10 million students in elementary and secondary schools exhibiting test anxiety (Wigfield & Eccles, 1988).

Testing situations occur frequently in schools and for many reasons. Some of these reasons include: to monitor progress, diagnose problems, measure intelligence and aptitude, and screen for admission to schools after high school (Hembree, 1988). Educational success depends to a large degree on success on various tests administered in school systems. Test anxious children are at a disadvantage when taking tests. Research suggests that the scores of these children tend to be lower than those of other children, "not from a lack of ability but from a dysfunction in trying to show it "(Hembree, 1988 p. 75). Since this anxiety can lead to poor school performance, there is a great effect on the child and possibly the child's future. It is possible that the effects of test anxiety can be

even more wide-spread when schools or teachers are held accountable for their students' performance on standardized tests. Obviously, test anxiety would appear to be well-suited for school-based interventions since the problem occurs in a school setting and can directly impact academic performance. Intuitively, it makes sense that relaxation techniques would be an appropriate intervention for students with this problem.

Chang and Hiebert (1989) in their review of studies published prior to 1989 found that while the effects of PMR on test anxiety were varied there was no support for the notion that PMR has a positive effect on outcome variables related to test anxiety such as test performance and grade point average. They also mention that the literature indicates that PMR is not superior to other behavioral treatments for the treatment of test anxiety. These findings echo those of Richter (1984) in his anecdotal review of the literature on test anxiety.

While test anxiety is common among students in elementary school through high school most treatment studies have used undergraduate university students as subjects. No studies published in the last 10 years related to test anxiety specifically with children and adolescents were located. However, prior to this time period Hembree (1988) conducted a meta-analysis examining the efficacy of different psychological treatments for test anxiety. This review looked at interventions for children and adolescents in grades K-12 as well as undergraduate and graduate college students. The reviewer did not differentiate between relaxation techniques as he included a wide range of techniques including cue-controlled relaxation and PMR augmented by biofeedback in his analysis. His analysis of 32 studies that examined relaxation techniques in the treatment of test-

anxiety found that these techniques were effective in reducing test anxiety and that these reductions were statistically significant. These findings are similar to those of other reviews which found that relaxation training can be effective in reducing anxiety. Unlike other reviews, Hembree (1988) found that relaxation training also had a positive effect on test performance. However, the treatment effects were not statistically significant and were not as large as the effects for other cognitive and behavioral treatments such as systematic desensitization and hypnosis. Hembree suggests that just because the positive effects in the majority of studies were not statistically significant does not mean the results have no educational significance. He found that the average improvement on test scores in high test anxious individuals compared to low test anxious individuals after a cognitive and/or behavioral intervention in general, not just relaxation, was 6 points based on a 100 point total. Depending on the child's beginning point, this could be a whole letter grade improvement, which could definitely be construed as educationally significant. However, Hembree does concur with the authors of other reviews that relaxation training does not appear to effect grade point average. It should be repeated that Hembree's review of the literature on test anxiety covered all relaxation treatments not only PMR and used subjects of a variety of ages.

General anxiety

Anxiety is characterized by excessive worry that is not focused on a specific situation or object. Estimated prevalence rates of anxiety disorders in youth vary greatly with most estimates falling between 5.78 and 17.7% (Silverman & Ginsburg, 1998).

According to Richter (1984) the studies he was able to locate concerning the use

of PMR with children and/or adolescents to treat generalized anxiety were "marked by a lack of scientific rigor and/or insignificant results (p. 330)." Chang and Hiebert (1989) only report of one study dealing with PMR and generalized anxiety and the successful outcome reported was based on anecdotal reports by the children in the study. Fortunately, there have been great improvements in the quality of research regarding anxiety in children and adolescents since that time period. Most studies located for the current review included a self-report and/or a parent report of the child's anxiety levels. This occurred regardless of the specific disorder being examined. Thirteen of the 23 studies reviewed used the State Trait Anxiety Inventory for Children (STAIC) to examine anxiety and 10 of those 13 showed a statistically significant improvement. Other measures of anxiety were also included in some of these studies and in other studies where the primary purpose was to explore the effects of PMR on other problems other than anxiety. In total, 17 of the 23 studies reviewed included some measure of anxiety and 13 of those studies showed improvements on at least one measure of either child or parents report of their child's anxiety. The eight studies cited in this section either included a measure of anxiety as the sole determiner of outcome or specified that the sample of children PMR was being used to treat had been selected to participate in the treatment group based on some diagnostic criteria for anxiety.

School-based interventions using PMR with children experiencing anxiety are a relatively new addition to the research on PMR and most of the research studies examining these interventions have been conducted in the last 11 years. One recent study examined the effectiveness of PMR to lower anxiety as measured by self-report in a group

of high school students (Rasid & Parish 1998). These researchers found lower state anxiety scores, though not trait anxiety scores, on the STAIC in a group of high school students who volunteered to receive training in PMR. However, it is important to state that this study presented no baseline or follow-up data, no adequate control for a possible placebo effect, and used a non-clinical sample. Eisen and Silverman (1993) examined PMR with a sample of children and adolescents in a clinical setting diagnosed with overanxious disorder and used a variety of anxiety self-report measures. They found improvement on all measures in all of the subjects but one and also found that these improvements were maintained at a 6-month follow up period. It should be kept in mind that the children varied widely in age (6, 9, 12, & 15) and nothing was done to account for the differing developmental levels of the sample. Another study by Eisen and Silverman (1998) used 4 subjects more closely grouped together by age (8, 11, 12, 12). These children were also diagnosed by a psychologist as having overanxious disorder. Each child participated in 5 weeks of each treatment (i.e., cognitive and PMR). All subjects in this study showed clinical improvement on all measures and results were maintained at a 6-month follow-up. An interesting aspect of Eisen and Silverman's research is that they attempted to differentiate treatment effects based on specific symptoms of anxiety matched with different treatments. They hypothesized that all subjects would benefit somewhat from treatment, whether that treatment be PMR based or cognitively based, but that subjects would benefit more from treatments that were prescribed based on the particular symptoms they were presenting. This hypothesis appears to be supported by their findings. Positive outcomes were obtained on all

measures but improvement was greater when the treatment matched the specific symptoms of the child (i.e., PMR training for children with somatic complaints and cognitive training for children with cognitive symptoms). These findings lend support to the idea that PMR is better suited as a treatment for somatic symptoms of anxiety rather than cognitive symptoms (Heide & Borkovec, 1983).

Hiebert and colleagues (1989) published the data from three studies that looked at a school-based relaxation program. The first study (Hiebert, Kirby, & Jaknavorian, 1989a) used physiological assessment measures as well as a self-report measure of anxiety to compare the effectiveness of PMR to biofeedback in reducing anxiety in high school students who were identified by their teachers as experiencing public speaking anxiety. They found significant improvements in all groups including the no-contact wait list control group, thus suggesting that the PMR treatment was not any more effective than the passage of time in reducing anxiety. The authors of this study hypothesize that these results were due to the fact that they used outside experts to conduct the training of the students which led to an expectation effect and therefore to the positive results in all conditions.

In the second study by these authors (Hiebert et al., 1989b) they tried to lessen the expectation effect by using the school's counselors to conduct the relaxation training. Their second study also used a younger sample (8^{th} grade) than the first study and included every 8^{th} grader in the school who agreed to participate in the study. This time only psychological measures of anxiety were assessed and there was no biofeedback condition. The results indicate slight improvement for the treatment group as compared to the

control group. However, there were not differences on all measures. Significant reductions were found in trait anxiety and there was an increase in academic self-confidence but no other significant changes were found. The authors of the study attribute these results, at least in part, to the lack of compliance of the treatment group to the home-based component of the PMR intervention. The third study by these authors (Hiebert et al., 1989c) found better results using the same treatment and same dependent measures as in the second study with a group of 12th grade students who chose the PMR course module as one of the components of a health, recreation, and fitness class they could choose from. The authors believe that the better outcome was because of the older age of this sample which in their view led to a higher compliance rate. However, because there was no difference between the treatment and control group in the first study which also used high school students, the different findings may be because the samples in the three studies were selected using a different criteria. In the third study, a large pool of students were given a choice of different units they could take in a health class at their school and the students in the sample were all those who specifically selected the PMR unit, which could have influenced the results. While this may have caused the treatment and control group to be different in many ways it also highlights the importance of matching the treatment to the needs of the client. The positive effects may have been elevated by the increased motivation of the self-selected sample which may not lead to clean data but shows the importance of motivated clients in the outcome of psychological interventions.

Another recent school-based study looked at stress management programs for

third and fourth grade students. Every third and fourth grade student in the school was eligible to participate in the study. Four different programs were examined: (a) knowledge-oriented, (b) PMR oriented, (c) problem-solving oriented, and (d) a combination of the 3 programs. The results indicate that the PMR oriented treatment while effective was the least effective of the four programs (Lohaus, Klein-Hebling, & Shebar, 1997). The authors theorize that this may be because PMR in isolation does not address the stress provoking environment specifically and only influences stress-related emotions.

It is difficult to generalize results from one study of PMR for anxiety to another because they vary so greatly. While the majority of the studies, regardless of the specific population they were looking at, examined the effects of PMR on at least one measure of anxiety (typically the STAIC) there is not much else in common between the studies. Of the eight studies that looked specifically at the effects of PMR on anxiety, sample sizes ranged from 4-170 and ages from 6-18. Only two studies examined the effects of PMR on a population diagnosed with an anxiety disorder and four of the studies used a sample of students taken from a general education setting with no diagnostic criteria at all.

The procedure used to administer PMR also varied widely across studies. Only two studies used PMR scripts designed to be used with children and only one used the most widely used PMR script published by Bernstein and Borkovec (1973).

In addition, because only two studies used a clinical population, they were the only two studies to report affirmative clinical significance. The remaining five studies did report statistically significant improvement on at least one of the measures used.

It should also be kept in mind that the number of sessions ranged from 4-33 and the amount of time spent in each session ranged from 20-90 minutes. More research is needed to determine the appropriate number of sessions and amount of time required in each session to treat anxiety with PMR.

Overall, PMR does seem to lower anxiety levels as measured by physiological measures such as heart rate and cortisol level and psychological measures such as standardized self-report measures. There are limited studies of PMR used to treat children and adolescents specifically for anxiety but those studies that do exist indicate that PMR works better for symptoms of anxiety that are more somatic in nature. PMR also appears to work better for older children and children who chose the treatment but there needs to be more research before any firm conclusions can be drawn.

Depression

Depression is characterized by a depressed mood, loss of interest or pleasure, or irritability. Depressed children and adolescents may also experience changes in weight, sleep disturbance, psychomotor agitation, fatigue, feelings of worthlessness, lack of concentration and decision making ability, and suicidal ideation, attempts or plans (American Psychiatric Association, 1994). It is estimated that between 5-7% of the general population in the fourth, fifth, sixth, and seventh grades may be experiencing a depressive disorder. This rate is much lower for children in lower grades and is extremely rare in kindergarten and preschool. The rate of prevalence of depression increases through junior and senior high grades and eventually reaches an adult level of

approximately 10% (Stark et al., 1997).

The studies located that examined the use of PMR to treat children and/or adolescents with depression operated under the assumption that PMR would have some positive effect on levels of anxiety but would not affect symptoms of depression as was found in the results of an earlier study (Reynolds & Coates, 1986). These present studies used PMR as a "placebo" treatment and the primary focus was on other psychological interventions such as massage or cognitive-behavioral therapy.

Interestingly, although there have not been many studies that have looked specifically at the effects of PMR on depression, the majority of those located indicated that PMR can be an effective treatment for depression in children and adolescents. One such study directly compared cognitive-behavioral treatment, relaxation (this treatment combined PMR with imagery and breathing exercises), and self-modeling in the treatment of depression in middle-school students (Kahn, Kehle, Jenson, & Clark, 1990). This study is of particular interest because it took place in a school setting. The results indicate that all treatments relative to the wait-list control group led to a clinically and statistically significant decrease in depression and increase in self-esteem. The group that received relaxation training did not show as much improvement as the group that received the cognitive-behavioral treatment although the improvement in the PMR group was clinically significant. This difference between the treatment groups and the wait list control group was maintained at 1-month follow-up. Another interesting finding of this study was that nearly all subjects rated their intervention program as at least "somewhat helpful" and all subjects rated their treatment as at least "somewhat enjoyable."

Another study found similar findings in a clinical setting. These researchers used PMR as a control condition in their examination of the effectiveness of a cognitive-behavioral intervention with children and adolescents who were depressed (Wood, Harrington, & Moore, 1996). They found that both groups improved on all measures of internalizing symptoms. Like the previous study mentioned, they also found that the cognitive-behavioral group showed a greater improvement on measures of depression and overall outcome. Both groups, however showed significant improvements in symptoms of anxiety. Unlike the study conducted by Kahn and colleagues (1990) though they found that these differences were reduced at a 3-month follow-up. At a 6-month follow-up it was found that while both groups still were much improved compared to pre-treatment the difference between the two groups were virtually non-existent. It should be kept in mind that this study did not include a wait-list control group and therefore passage of time may be responsible for some of the improvements seen..

Two clinic-based studies examined PMR as a placebo. A study by Field, Grizzle, Scafadi, and Schanberg (1996) compared the effects of massage therapy to PMR in the treatment of depressed adolescent mothers. They found that the group receiving PMR did experience lower anxiety as measured by the STAIC but did not score lower on the depression measure used or any of the physiological measures. In comparison, the group that received massage therapy in addition to reductions in anxiety also showed a reduction in depression and stress. In this study PMR was used as a "placebo" treatment and there was no wait list control group. In addition, it should be noted that there were no follow-up measures. Data were only taken immediately following the treatment conditions.

A second study conducted by Field (1992) used PMR in combination with visual imagery and a brief massage to study the effects of relaxation on anxiety in children and adolescents with depression or adjustment disorder. She used a variety of physiological and psychological assessment measures. The results of this study indicate that the relaxation training group showed significant improvement on all of the measures compared to the control group. The control group received no active treatment but instead was instructed to view a "relaxing" video tape.

The above studies support the premise that while PMR should probably not be the sole treatment for depression in children and adolescents, it may be a helpful add-on treatment. A few studies obtained outcomes that showed PMR to reduce symptoms of depression significantly and all of the studies located that used PMR with a depressed adolescent or child sample found significant reductions in symptoms of anxiety. This finding is important because studies indicate that 30 to 75% of clinically depressed youth have a diagnosable anxiety disorder (Schwartz, Gladstone, & Kaslow, 1998). Since the symptoms of anxiety disorders and depressive disorders often overlap, PMR may be a useful adjunct treatment or component of a more comprehensive treatment package for depression and anxiety in children. PMR is also a treatment that can easily be administered by a school-based practitioner and should be considered as a component of treatment of depressed students in schools, especially when symptoms of anxiety are present.

It should be kept in mind that there was a considerable variation between studies. The ages of subjects ranged from 8 to19 and sample sizes ranged from 32 to 68. The

number of treatment sessions ranged from 1 to 12 and the length of each session was 30 minutes in two of the studies and unspecified in the other two. Study-specific PMR treatment manuals were used in three of the studies and Bernstein and Borkovec's treatment manual (1973) was used in one study. Also, two of the studies did not present follow-up data, one study presented data from a one month follow-up assessment, and one study included data obtained from both three and six month follow-up assessments.

Asthma

Asthma is the most prevalent chronic health-related disorder in childhood, affecting approximately 4.8 million children under the age of 18 (Mesquita & Fiorello, 1998). Asthma has three main characteristics: inflammation of the airways, increased sensitivity of the airways to triggers that result in narrowing of the airway, and an obstructed airflow which leads to breathing difficulty (Bender, 1999). Many psychological interventions for asthma incorporate relaxation as a component of a more comprehensive treatment package but very few studies have been conducted that look solely at the effects of PMR for controlling symptoms of asthma. The use of PMR with this population is based on the premise that asthma attacks are associated with increased autonomic arousal and increased emotional distress, therefore PMR should provide some relief for asthma symptoms by decreasing arousal (McQuaid & Nassau, 1999). Of course as mentioned in an earlier section, the autonomic arousal theory of PMR has not been empirically validated.

The studies that have been conducted with adults have shown only small and brief

increases of air flow (Kotses, 1999) after a PMR intervention. One such study found that adults with asthma who were treated with PMR showed a high subjective feeling of relaxation and a small but not clinically significant change in pulmonary functioning (Lehrer et al., 1994).

Studies with children have obtained similar results. Field and her colleagues (1998) had the parents of children with asthma administer PMR training 15 minutes a night for 30 nights. They found that the only statistically significant positive outcome was that parents reported lower anxiety levels. Vazquez and Buceta (1993b; 1993c)examined the effects of PMR on a sample of children ages 8-13 diagnosed with either mild or moderate asthma and found that PMR produced no improvement of asthma symtomatology in one study and statistically significant but not clinically significant improvement in the other. When PMR was combined with a self-management intervention it was found that PMR did not improve the efficacy of the treatment (Vazquez & Buceta, 1993b). These findings imply that while PMR may be somewhat beneficial for controlling symptoms of asthma the benefits are small and not clinically significant, suggesting that PMR should only be used as an adjunct to medical management (Lehrer, Sargunaraj, & Hochran, 1992).

Research also seems to indicate that certain sub-populations of children and adolescents with asthma may benefit more from PMR than others. There is some evidence that PMR may be especially useful with children who experience emotional triggers to their asthma episodes (Lehrer, 1998). As mentioned above, Vazquez and Buceta (1993a, 1993b, 1993c) investigated PMR in the treatment of children with asthma and found that PMR alone did not produce global changes in pulmonary function. However, in one of

their studies they examined whether a history of emotionally triggered asthma attacks affected the child's response to PMR. They found that compared to self-management alone, self-management with PMR decreased the duration of asthma attacks the most in children with a history of emotional triggers. Also, pulmonary function variables showed greater changes over time in these children compared to children without a history of emotional triggers (Vazquez & Buceta, 1993a).

A major shortcoming of all the asthma research studies obtained for this review is their lack of any follow-up data. This makes inferring clinically relevant positive outcomes from PMR with this population difficult. Sample sizes in these studies varied from 18 - 27 and the ages of the subjects ranged from 4-14. Three of the studies used PMR administered by a psychologist during 6 sessions with each session lasting 60 minutes. The fourth study used PMR over a course of 30 sessions, each lasting 20 minutes and administered by the children's parents. Three of the studies used Bernstein and Borkovec's treatment manual (1973) and the other study used a study-specific procedure.

The overall findings of the use of PMR with most children and adolescents with asthma is not encouraging as it does not seem to add to other psychological treatments for this disease. However, the findings of Vazquez and Buceta (1993a) indicate that PMR may be a useful component of a more comprehensive treatment plan for children with emotionally triggered asthma attacks. After consulting with the child's physician, the school psychologist could play an important role in facilitating self-management of this disease. One way in which a school psychologist could accomplish this is through functional assessment to determine the presence of emotionally triggered antecedents to

asthma attacks. Another way to increase the the role of the school psychologist could be through training children who met the criteria of experiencing emotionally triggered asthma attacks in PMR. This should only be done in concert with a medical professional and only when deemed appropriate. It is also important that PMR only be used as a component of a more comprehensive pharmacological and psychological symptom management plan.

Headaches

Recurrent headaches are common in childhood and adolescence. They are characterized by repeated painful episodes experienced across many months that occur without a well defined organic pathology. It is estimated that recurrent headaches appear in about 5-10% of all children under the age of 10 and 11-15% of all adolescents (Allen, Matthews, & Shriver, 1999).

A meta-analysis by Hermann, Kim, and Blanchard (1995) examined behavioral and preventative pharmacological treatments of pediatric migraines. They used a stringent inclusion and exclusion criteria and examined a total of 41 studies over a 23 year time period (1970-1993). They found that interventions combining biofeedback and PMR were more effective in producing a favorable outcome than other behavioral treatments and the more commonly used prophylactic drug regimens, but that all of these treatments were shown to be superior to placebo or wait-list control. However, they stress that there is a need for more studies that directly compare behavioral and pharmacological treatments.

Two clinic-based studies were located. Engel (1993) examined the effectiveness

of PMR to treat headaches in children and adolescents as well as their compliance to the treatment. This study found that there were significant decreases in multiple headache indices for 8 out of 10 subjects and that mean compliance to treatment across subjects was 84%. No follow-up data were reported in this study.

A clinic-based study conducted in Holland compared biofeedback to a combination of PMR, music, and imagery (Kroner-Herwig, Mohn, & Pothmann, 1998). Only childeren with tension headaches or children who had migraine headaches in addition to tension headaches were included in the study. The results indicated that approximately half of the relaxation group had a clinically relevant improvement. However, this improvement was not as high as that found in the biofeedback group. While half of the children treated with relaxation training showed a positive change as many as four to seven of the twenty subjects showed some deterioration or no improvement. This is compared to only one or two showing deterioration or no change in the biofeedback group. This study also looked at parental involvement in these interventions and found that it made no difference regarding outcome. It was also found that reduction of frequency, intensity, and duration of headaches was even more pronounced at a 6-month follow-up than immediately following the intervention for both treatment groups. This was the first randomized study to compare relaxation to biofeedback in the treatment of children's tension headaches and further studies need to be conducted before firm conclusions can be drawn regarding the superiority of either biofeedback or relaxation training in treating tension headaches.

Two studies looked at treating school-based settings. The first examined the effects of PMR for the treatment of headaches in a classroom setting (Passchier et al.,

1990) and found no differences between the treatment group and the control group. In this case, the control group received "placebo" training consisting of "physical concentration exercises." It should be noted that the inclusion criteria for this study was rather lax. Students who reported at least one headache in a 3-week period were included in this study. This provided a large sample but perhaps the lack of differences between the two groups was due to the fact that the children in the sample never met any clinically derived diagnosis of recurrent headache and therefore one would not suspect that PMR (or any treatment for that matter) would make much of a difference.

Only one additional study focused on the effects of PMR in a school-based setting (Larsson, Melin, & Doberl, 1990). A sample of high school students who reported a frequency of headaches occurring more than once per week over the course of a year was used in this study. The sample was divided into two different groups and treatment was broken down into four 5-week periods. During the first time period, group one learned PMR which they then used alone with the assistance of a treatment manual and audiotapes. Group two was on a waiting list the first five weeks. During the second 5-week period a pharmacological prophylactic treatment was introduced (chlormezanone) to half of group one while the other half received a drug-placebo. Group two began relaxation training during this time period. In the third 5-week period, the half of group one that received chlormezanone received the placebo and the half that had previously taken a placebo was placed on the medication. At this time group two also started the medication phase following the same pattern as group one. Only group two participated in the fourth 5-week period using an identical protocol to group on in the third 5-week

period. Following treatment statistical analysis was conducted and it was found that the addition of chlormezanone did not help those who were non-responders to relaxation training. In the PMR group, statistically significant positive improvements were found in measures of somatic symptoms, anxiety, depression, and stress. However, while results of this study indicate that the subjects did improve on headache indices at a statistically significant rate, the majority of them (80.6%) did not reach a level of clinically significant improvement. These results were found during a posttreatment assessment and after the high school students had received the prophylactic pharmacological treatment. Interestingly, these researchers also included a measure of treatment acceptability and found that the high-school students in their sample rated PMR as a more highly credible treatment than medication.

A study which took place in a clinical setting used a more stringent criteria for inclusion than the other studies in this review, including an assessment by a physician (Sartory, Muller, Metsch, & Pothmann, 1998). This study directly compared PMR to biofeedback and to a pharmacological treatment (Metoprolol). Children between the ages of 8-16 were used in the study. Both of the psychological treatments also employed a stress-management component. This study found that PMR combined with the stress management was significantly more effective in reducing headache frequency and intensity than both metoprolol or biofeedback and that results were stable at a 8-month follow-up.

Some of the same variance that has been found in studies concerning the use of PMR with other childhood disorders also exist in the research on recurrent headaches. The number of sessions ranged from 5 to 10 and the time of each session lasted from 10-

20 minutes to over 60 minutes. Studies included sample sizes ranging from 10 to 202 subjects with the ages of subjects being anywhere from 8 to 18 depending on the study. Three of the studies did not include follow-up data; one study presented data from a 6-month follow-up assessment; and another showed data from a 8-month follow-up assessment. Two of the studies used study-specific PMR procedures while the remaining three used treatment manuals based on the manual created by Bernstein and Borkovec (1973). It should also be noted that pediatric headaches are not homogeneous and there is generally greater support for the efficacy of psychological approaches for migraine than for tension or mixed headaches in children and adolescents (Holden, Deichmann, & Levy, 1999). The studies included in this review varied in the diagnostic criteria used and only one (Larsson et al., 1990) used a sample whose primary diagnosis was tension headaches. This difference between studies in diagnostic criteria could account for the variation in findings.

There have only been a few studies of PMR in school-based settings and as alluded to above, the evidence is mixed. In addition, the studies that have been conducted have taken place in non-English speaking European countries. Therefore, the results obtained are not necessarily generalizable to the United States or other English speaking areas. More studies are needed before any conclusions on the efficacy of PMR to treat headaches in school-based settings can be solidly drawn. However, sufficient evidence does exist from treatment outcome studies in other settings to conclude that relaxation training is an efficacious treatment for recurrent pediatric headaches.

ADHD

Attention-Deficit/Hyperactivity Disorder (ADHD) is characterized by an abnormally high level of inattention and/or hyperactivity and impulsivity. The prevalence rate of ADHD is approximately 3 to 5% in school-age children (Barkley, 1998). Most of the disorders which have been or will be discussed in the current review concerning children and adolescents have not been rigorously studied to the point where enough is known about them to label a particular treatment as most efficacious. This is not the case with ADHD, where stimulant treatment has been found to be more effective than other treatments in controlling the core symptoms of ADHD. Nonpharmacological approaches such as behavior modification and parent training have also been found to be beneficial, although it should be kept in mind that nonpharmacological approaches typically pale relative to stimulant treatment and it may be that psychological interventions do not make any significant additive contribution to stimulant treatment for the core symptoms of ADHD (Whalen & Henker, 1998).

That being said, the theory behind using PMR as an intervention with children with ADHD is that hyperactive children are overly tense along with being overactive and that high muscular tension levels could exacerbate ADHD symptomatology (Braud, 1978). Several studies published prior to 1989 examined the effects of PMR on children with ADHD (e.g., Porter & Omizo, 1984; Braud, 1978). Most of these studies obtained positive results but the dependent measures included muscle tension, self-concept, etc. and typically not measures that purport to assess ADHD. Richter (1984) cites some of the

same studies as Chang and Hiebert (1989) and indicate that none of them included follow-up data.

Only one study was located post 1988 that examined the use of PMR with adolescents with ADHD (Field, Quintano, Hernandez-Reif, & Koslowsky, 1998) and this study was primarily examining the effects of massage therapy and used relaxation training as the control group treatment. These researchers found no significant pre/post session changes for the PMR group. This study included the Connners Rating Scales, which assesses ADHD behaviors, as one of their dependent variables.

Findings indicate that PMR is not an effective treatment for the reduction of symptoms of ADHD although it may be useful as an adjunct treatment for children and adolescents with this disorder who are also experiencing tension or other symptoms of anxiety. However, it should be kept in mind that there is a paucity of well-controlled studies in this area and that any conclusions reached about the effectiveness of PMR with this population should be considered tentative.

Other Disorders/Conditions

Juvenile Rheumatoid Arthritis

Juvenile rheumatoid arthritis (JRA) affects as many as 1 in 1,000 children in the United States (Robinson, 1998) and is a chronic inflammatory disease of the joints. Only one study was located that examined the effect of PMR on JRA and that study's primary focus was on massage therapy (Field, Hernandez-Reif, Seligman, Krasnegor, & Sunshine, 1997). This study found that the group of children who received PMR showed some

improvement on a self-report of anxiety symptoms, cortisol level, self-report of pain and physician's report of pain. However the improvements were not statistically significant nor were they better than the outcomes of the group of children receiving massage therapy. It should also be noted that these results were obtained after only one post-treatment assessment and there was no follow-up assessment.

Tourette Syndrome

Tourette Syndrome (TS) is a tic disorder characterized by involuntary, repetitive, brief movements and/or vocalizations. It is estimated to occur in 4 to 5 individuals per 10,000 (American Psychiatric Association, 1994). TS is not associated with behavioral, emotional, or learning problems per se but TS does have a high comorbidity with other disorders such as ADHD and obsessive compulsive disorder (Power & Mercugliano, 1997).

Only one study was located that specifically examined PMR in the reduction of tics in children and/or adolescents with TS (Peterson & Azrin, 1992) and of the 6 subjects in this study only 2 were under the age of 18. This study compared the effectiveness of self-monitoring, PMR, and habit reversal. It was found that while tics were reduced by all three treatments, PMR was the least effective intervention. However there was a large variance between subjects. For the two subjects under 18, the tics of the 13-year-old were reduced by only 2% by PMR, conversely, the tics of the 10-year old were reduced 50% by PMR.

Overall Effectiveness of PMR

Progressive muscle relaxation techniques have been studied systematically for over 60 years but only in the past 30 years have researchers examined the efficacy of these techniques with children. Twenty three studies published within a ten year period were found that met the inclusion criteria for the current review. The increase of research on PMR with school-age populations is encouraging because if found to be efficacious in treating problems in childhood and adolescence, PMR could prove to be a valuable intervention strategy for school-based practitioners. This is partly because PMR is a cost-effective, non-intrusive intervention that once learned can ideally be implemented by the student him or herself prior to, or at the onset of, the problem behavior that is being targeted. However, it should be kept in mind that while research regarding the effectiveness of PMR with children is increasing there is still a need for further research in this area.

In the time since the last review of the literature (Chang & Hiebert, 1989) many more research studies have included a "placebo" control group. This has addressed many threats to internal validity that others have noted being present in the majority of the research on PMR with children and adolescents. The findings of recent studies imply that PMR is an effective treatment for somatic symptoms of anxiety and headaches. PMR is also a useful component of treatment packages for depression and emotionally triggered asthma attacks.

Limitations of the research

The primary question posed by Richter (1984), Chang and Hiebert (1989), and

others regarding the efficacy of PMR with children and adolescents has yet to be answered. That question being, how effective is PMR by itself as a treatment for children and adolescents? There are potentially many reasons that this question has not been answered, one is that most relaxation scripts used in the studies evaluated for this and other reviews were designed to be used with adults (e.g., Bernstein & Borkovec, 1973). Therefore, children may find the instructions for PMR difficult to comprehend. Boredom may also an issue because relaxation scripts designed for adults do not take into account the shorter attention-span of children. Scripts for children have been developed (See Ollendick & Cerny, 1981 for one example) but for the most part were not used in these studies. The exceptions were two studies of the effects of PMR on anxiety published by Eisen and Silverman (1993, 1998). There have been few studies, especially controlled studies, regarding the efficacy of school-based interventions based on the principles of PMR (King et al., 1998). King and his colleagues remark that the school-based interventions involving PMR that have been conducted have shown only modest improvements and therefore goals for programs incorporating these interventions in school settings should be modest (King et al., 1998).

One of the problems with the research reported by Richter (1984) and others was the lack of follow-up data. In the studies Richter reviewed, only 8 out of 26 reported follow-up data (31%). In the current review 7 out of 23 studies reported follow-up data for a rate of 33% indicating that there has not been much improvement in this area over the years. The lack of follow-up data reported in these studies limits their clinical usefulness.

A possible shortcoming of the research not noted in previous reviews is the wide range of ages among subjects in a given study. Age-related characteristics should be taken into account when deciding whether or not to implement PMR as a treatment with a particular client. Bernstein, Borkovec, and Hazlett-Stevens (2000) believe that success at learning relaxation skills requires three things. First, the client must be able to give focused attention to the muscles of his or her body and to the voice of the therapist; second, the client must possess the ability to systematically tense and release specified muscle groups; and third, the client must be able to regularly practice the skills learned in treatment sessions. They believe that "these requirements eliminate most very young children" (p. 13) but the authors do not specify what constitutes "very young." Twelve of the 21 studies examined in the current review of the literature used a sample in which the difference between the ages of the subjects ranged 5 or more years. A wide range in the age of subjects may not make a large difference in studies of treatment procedures with adults but there is a large difference, developmentally speaking between a 8-year-old and a 13-year old. Six of the studies examined used a sample with either a 9 or 10 year age range between subjects. While one of these studies used a within-subjects experimental design, the others used a between-groups experimental design, making overall findings difficult to interpret.

Another limitation of the research is that many of the studies located for the current review included no measure designed to assess if the child had learned PMR skills or if he or she had actually obtained a state of relaxation. Obtaining this information is imperative to ascertaining the clinical utility of PMR with children. Clinicians need to

have some standardized method of discerning whether or not their clients have learned the skill being taught. Physiological measures such as EMG or heart rate give some indication of state of relaxation and may be useful in a clinic or hospital setting but are impractical to use in a school setting. Standardized behavioral observation measures such as the Behavioral Relaxation Scale (Poppen, 1988) show promise but have not yet been thoroughly studied to the point where validity and reliability can be shown. This may be an area where school-based practitioners can contribute to the PMR efficacy literature. Because physiological measures are not typically available in a school setting, the most feasible means of assessing how well a child has learned PMR in a school setting are behavioral in nature. School psychologists have typically been trained in methods of behavioral observations and data collection and are in an ideal situation to assess the effectiveness of such measures as the Behavioral Relaxation Scale.

Implications for School-Based Practitioners

There are many reasons PMR may be an attractive treatment option for school psychologists, and other school-based mental health practitioners. It is free of negative side-effects, as effective as many other treatment approaches, and cost-effective (Richter, 1984). In addition, studies have shown that relaxation training typically receives high acceptability ratings by students, parents, teachers, and other professionals (King & Gullone, 1990; Larsson, Daleflod, Hakansson, & Melin, 1987; Wood et al., 1996). Unfortunately, there is a paucity of research regarding the use of these techniques with children in school-based settings. What evidence does exist is mixed. One study of

headaches showed a significant reduction of headaches in students who were trained in PMR (Larsson, 1990) while another study did not (Passchier et al., 1990). Mixed results have also been obtained in school-based PMR treatments for anxiety. The research of Eisen and Silverman (1993, 1998) and Passchier and colleagues (1990), highlight the importance of fitting the intervention to the particular needs of the individual. Perhaps some of the differences found in these studies can be accounted for by differences in various samples regarding headache symptoms or symptoms of anxiety as discussed in previous sections. The key to determining whether PMR is an appropriate intervention for an individual may depend on the degree to which that individual is experiencing tension, stress, or somatic symtomatology. This can be determined in part by a functional analysis with an emphasis on identification of antecedents to behavior.

If school psychologists or other practitioners wish to incorporate PMR into their treatment reportoire, they should note that recent research indicates that PMR may work best as a prescriptive treatment targeted at specific individuals with specific behaviors. There are many relaxation programs that advertise themselves as appropriate for school-wide intervention. It should be kept in mind that this claim has not been supported by research.

It is also important for school-based mental health professionals to keep in mind that many children and adolescents with psychological disorders and virtually all children with chronic health conditions are being treated in settings outside of the school. Therefore, it is imperative that assessment and interventions with those students be conducted in collaboration with appropriate outside professionals.

Another issue to consider is the training of school-based practitioners and whether or not they are interested in using PMR procedures. Most training programs in school psychology do not provide training in relaxation procedures. In addition, a survey of 80 secondary school counselors found that relaxation techniques are not widely used by school counselors. Less than 40% of those who responded to the survey believed that relaxation training is an effective method for treating adolescents with behavior problems. Three fourths of those school counselors did not use relaxation techniques in their practice, and only half of those respondents would consider learning relaxation techniques (Laselle & Russel, 1993). Perhaps, if these techniques are found to consistently produce significant positive outcomes in school-based research, this would change.

Only one review of PMR solely in school-based settings was located (King, et al., 1998). This journal article was not included previously in the current review because it was not an exhaustive review of the literature, rather, it basically summarized the findings of Richter (1984) and examined the findings of two school-based relaxation training programs for the treatment of chronic headaches in adolescents and four school-based relaxation training programs for test anxiety. The individual studies that King and colleagues (1998) examined in their review that were published since 1988 were also included in this review.

In the aforementioned review, King and colleagues (1998) make some good points and suggest that if school-based practitioners do choose to utilize PMR as an intervention with students, several things should be kept in mind. Namely, (a) that if these procedures are to be used in the schools appropriate assessment of their efficacy be conducted; (b)

that school-based practitioners should be cognizant of the cognitive-developmental abilities of children and adolescents and that this may limit the effectiveness of PMR in certain populations; (c) studies regarding the efficacy of PMR typically find improvements that are of dubious clinical and educational significance; and (d) that PMR should rarely be used alone to treat school-based problems but as a component of more comprehensive treatment programs (King et al., 1998).

King and associates conclude that it would be prudent to exercise caution when using PMR as a school-based intervention. They base their conclusions on the premise that overall findings of the efficacy of PMR with children have been inconsistent. They also believe that PMR should not be viewed as a cost-effective panacea for all school-based ills. The findings of the current review are mostly consistent with the findings of King and colleagues (1998) although they may have been a little too harsh concerning the clinical utility of PMR in a school-based setting. While it should not be the only treatment method used, PMR is cost-effective and time effective. There are also standardized treatment manuals easily available that have been widely studied in clinical settings and at least somewhat in a school-based setting with a school-age population (Bernstein & Borkovec, 1973). However, it should be noted that most standardized treatment manuals were not designed specifically for children and/or adolescents. Popular treatment manuals such as the one published by Bernstein and Borkovec use words such as tense, release, and relax that many children may not understand. There are standardized PMR treatment manuals marketed towards childhood populations but none have been examined thoroughly. If a school-based practicioner wishes to use PMR as a treatment he or she

should keep the developmental level of their clients in mind and simplify words found in standardized treatment manuals when appropriate. Progressive muscle relaxation may not appropriate for younger children or for those with developmental delays. The research indicates that PMR is most effective with children from upper elementary school grade levels through high school. These relaxation techniques are probably not an effective treatment for children in lower elementary grades.

It has also been shown that parents and teachers may see this treatment to be desirable and effective (King & Gullone, 1998). In addition, other interventions that have been shown to decrease the muscle tension related to disorders examined in this review (e.g., biofeedback, medication) may be unavailable or impractical to use in a school-based setting. Also, PMR can easily be administered in most school-based settings. Therefore, the use of PMR in school-based settings with children and adolescents should continue to be studied and considered by school-based clinicians as at least a component of treating the aforementioned conditions.

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Appendix 1: Summary of Intervention Studies

PMR/ Anxiety

Eisen, A. R., & Silverman, W. K. (1993). Should I relax or change my thoughts? A preliminary examination of cognitive therapy, relaxation training, and their combination with overanxious children. *Journal of Cognitive Psychotherapy,* 7(4), 265-279.

Sample. N= 4 (6-15 years, 50% female).

Diagnostic criteria. Primary diagnosis of overanxious disorder (OAD) based on DSM-III-R *criteria.*

Experimental design. Within subjects, AB design.

Assessment measures. Revised Children's Manifest Anxiety Scale (RCMAS); the trait version of the Sate-Trait Anxiety Inventory (STAIC-T); Fear Survey Schedule for Children-Revised (FSSC-R); Child Behavior Checklist (CBCL); Parent Ratings of Severity (PROS); Parent Weekly Records (PWR); clinician rating scale used by independent clinicians to determine severity of each child's DSM-III-R diagnosis at pre-treatment, post-treatment, and follow-up.

Treatment protocol. Subjects received 6 sessions of cognitive training (CT), 6 sessions of relaxation training (RT), and 6 sessions of a combined treatment for a total of 18 sessions. RT based on manual by Ollendick and Cerny, 1981).

Baseline. Between 9 and 18 days.

Results. On child self-report measures every subject who scored in the clinical range at pre-treatment on the RCMAS, (except for case 1) STAIC-T, and FSSC-R (except for case 1) scored within normal limits at post-treatment or follow-up. Parent ratings on the CBCL and PROS were also positive and the child and parent measures were corroborated by clinician ratings. All three treatments were associated with diminished anxiety.

Follow-up. Results maintained at 6 month follow-up.

Eisen, A. R., & Silverman, W. K. (1998). Prescriptive treatment for generalized anxiety disorder in children. *Behavior Therapy,* 29, 105-121.

Sample. N= 4 (100% male; 50% Hispanic and 50% Caucasian). Ages: 8-12 (8, 11, 12, 12). Referred to the Child Anxiety and Phobia Program at Florida International University

in Miami. Two subjects had symptoms that were more somatic in nature and two subjects had symptoms that were more cognitive in nature.

Diagnostic Criteria. Principle diagnosis of DSM-III-R overanxious disorder with at least moderate impairment based on 0-8 point clinician rating scale. Participants had history of overanxious concerns for at least 3 years. Subjects were excluded from participation in the study if their overanxious disorder was secondary to other disorders or if they were currently undergoing pharmacological or any other treatment for presenting problems.

Experimental Design. Multiple baseline across participants.

Assessment Measures. Child and parent versions of the Anxiety Disorders Interview Schedule for DSM-III-R (ADIS-C; ADIS-P); the Revised Children's Manifest Anxiety Scale (RCMAS); the Children's Negative Cognitive Error Questionnaire (CNCEQ); the Childhood Anxiety Sensitivity Index (CASI); daily diaries of anxiety provoking situations and degree of anxiety; the Child Behavior Checklist (CBCL); Parent Ratings of Severity (PROS); heart rate.

Treatment protocol. Subjects received 10 sessions (2 per week) of cognitive response class treatment (CRCT) which involved the identification and modification of worrisome thoughts and was conducted according to a written treatment manual. Subjects also received 10 sessions of somatic response class treatment (SRCT) which consisted of the use of PMR according to a written script by Ollendick and Cerny (1981). Both treatment interventions consisted of meeting with the child for 45 minutes, the parents for 30 minutes, and both parties for 15 minutes.

Baseline. Between 3 and 6 days.

Results. All subjects showed clinical improvement on self-report, diary, and heart rate measures but improvement was greater when the treatment matched the specific symptoms of the child (i.e., SRCT for children with somatic complaints and CRCT for children with cognitive symptoms).

Follow-up. Results were maintained at 6-month follow-up.

Field, T. (1992). Relaxation therapy reduces anxiety in child and adolescent psychiatry patients. In T. M. Field, P. M. McCabe, & N. Schneiderman (Eds.), *Stress and Coping in Infancy and Childhood.* Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc.

Sample. N= 40 (60% female). Ages: 8-18 (m= 13.9). Sample was taken from a

hospital's child and adolescent psychiatric unit.

Diagnostic criteria. Subjects had to be diagnosed as either having depression or adjustment disorder according to a psychiatrist using DSM-III-R criteria.

Baseline. Pre-treatment assessment.

Experimental design. Randomized, controlled group outcome design.

Assessment measures. Heart rate; saliva sample for cortisol; the State Anxiety Inventory for Children (STAIC); the Profile of Mood States (POMS) depression factor items; actometer readings; behavior observation ratings (study-specific).

Treatment protocol. Treatment: Relaxation therapy (RT, study-specific, incorporates yoga for 30 minutes, PRT for 30 minutes, 2 to 3 minute massage with visual imagery), one 1 hour RT group session. Control: This group watched television for a similar period of time as the length of the RT session.

Results. RT group showed significant improvement on all measures compared to control group. Only adjustment disorder group and about 1/3 of the depression group showed reduced levels of cortisol.

Follow-up. No follow-up data reported.

Hiebert, B., Kirby, B., & Jaknavorian, A. (1989). School-based relaxation: attempting primary relaxation. *Canadian Journal of Counseling,* 23(3), 293-287 (Study 1)

Sample. N= 40 (75% female). Age: 15-17 (mean-age= 15.6). Subjects were 10th grade students in a large suburban school in Western Canada.

Diagnostic criteria. Subjects were identified by their teachers as experiencing public speaking anxiety and scored above the third sten on the Institute for Personality and Ability testing (IPAT).

Baseline. One pre-treatment assessment.

Experimental design. Randomized, controlled group outcome design.

Assessment Measures. State-Trait Anxiety Inventory (STAI); subjective self-report of heart rate, respiration rate and finger temperature; Psychophysiological Stress Profile (PSP); frontalis electromyograph (EMG); peripheral skin temperature (PST).

Treatment protocol. Treatment 1: Biofeedback (study-specific), eight 40-minute weekly sessions or until subjects attained a priori training criteria. Treatment 2: PRT based on Hiebert, 1980); control: no-contact control condition (NCC), wait-list.

Outcome. Significant improvement on all measures. However, results were similar across treatment groups including the control group.

Follow-up. No follow-up data reported.

Hiebert, B., Kirby, B., & Jaknavorian, A. (1989). School-based relaxation: attempting primary relaxation. *Canadian Journal of Counseling,* 23(3), 293-287 (Study 2).

Sample. N= 113 (28 females in treatment group and 29 in control group; 34 males in treatment group and 22 in control group). Age: 13-14. Subjects were all 8th grade students in a large junior-senior high school in a large suburban area in Western Canada (not the same school used in study 1).

Diagnostic criteria. All 8th grade students in the school were included in the sample.

Baseline. One pre-treatment assessment.

Experimental design. Randomized, controlled group outcome design.

Assessment measures. State-Trait Anxiety Inventory (STAI); The Symptoms of Stress Inventory (SOSI); Self-Description Questionnaire (SDQ).

Treatment protocol. Treatment: PRT (as used in Study 1, included home practice component) conducted by teachers who were also guidance counselors. One hour sessions 3 times a week for 11 weeks. Control: unit on career education (study-specific,), 3 times a week for 11 weeks for 1-hour sessions.

Outcome. The treatment group showed significant decreases in trait anxiety and a larger increase in academic self-concept than the control group. However, there were no other differences between groups. Also, approximately 50% of the treatment subjects did not follow the program as intended (i.e., home-practice) although they did participate in school.

Follow-up. No follow-up data reported.

Hiebert, B., Kirby, B., & Jaknavorian, A. (1989). School-based relaxation: attempting primary relaxation. *Canadian Journal of Counseling,* 23(3), 293-287 (Study 3).

Sample. N= 22. Treatment group (n= 16); control group (n= 14). Ages: 17-18. Subjects were recruited from the same school as Study 3. Subjects were in either 11th or 12th grade. PRT was offered as a course module in a Health, Recreation, and Fitness Class that the students had the choice to select.

Diagnostic criteria. None.

Experimental design. Randomized, controlled group outcome design.

Baseline. One pre-treatment assessment.

Assessment measures. The same measures that were used in Study 2.

Treatment protocol. The same protocol was used as in Study 2.

Outcome. Both groups showed an increase in self-esteem. The PRT group showed greater improvement than the control group in stress symptoms, state anxiety and trait anxiety. Assessment of home practice logs indicated that this group of students had a higher compliance rate with treatment that the subjects in Study 2.

Follow-up. No follow-up data reported.

Lohaus, A., Klein-Hebling, J., & Shebar, S. (1997). Stress management for elementary school children: a comparative evaluation of different approaches. *European Review of Applied Psychology,* 47(2), 157-161.

Sample. N= 170 (42% female). Ages: 8-11

Diagnostic criteria. Children had to be in either third or fourth grade to participated in the study.

Baseline. One pre-treatment assessment.

Experimental Design. Randomized, controlled group outcome design.

Assessment measures. Questionnaire that contained questions about the stress experience and preferred coping strategies (study-specific); questionnaire for parents (study-specific).

Treatment protocol. Treatment 1: Knowledge oriented stress management program (study-specific). Treatment 2: Relaxation-oriented stress management program (study specific based on Jacobson, 1938). Treatment 3: problem-solving-oriented stress

management program (study-specific). Treatment 4: combined version of components of other three treatment programs (study-specific). Control: wait-list control. All treatment programs consisted of 8 sessions lasting 90 minutes each. Each treatment group was broken down into a parent involvement and no parent involvement condition (study-specific).

Outcome. The problem-solving version led to the most favorable results, followed by the combined, the knowledge-oriented, and the relaxation oriented version. Parent involvement did not lead to measurable effects for any of the criteria in any of the treatment groups.

Follow-up. Results were stable at 6-month follow-up.

Rasid, Z. M. & Parish, T. S. (1998). The effects of two types of relaxation training on students level of anxiety. *Adolescence,* 33, 99-101.

Sample. N= 55 (53% female).

Diagnostic criteria. Subjects were all high school students.

Baseline. None reported.

Experimental design. Randomized, controlled group outcome design, post-only.

Assessment measure. State-Trait Anxiety Inventory (STAI).

Treatment protocol. Treatment 1: Behavioral relaxation (based on Schilling & Poppen, 1983). Treatment 2: PRT (based on Bernstein & Borkovec, 1973). Control. No treatment control. All training for the treatment groups was conducted via videotape. Sessions were conducted as a large group. Treatment continued for two weeks and consisted of four 20-minute sessions. STAI was given 1 day after treatment concluded.

Outcome. Subjects in both of the relaxation groups demonstrated significantly lower State anxiety scores than the control group. There was no difference between groups for Trait anxiety. There was no difference between treatment groups.

Follow-up. No follow-up data reported.

PRT/ Arthritis

Field, T., Hernandez-Reif, M., Seligman, S., Krasnegor, Sunshine, W.,

Rivas-Chacon, R., Schanberg, S., & Kahn, C. (1997). Juvenile rheumatoid arthritis: benefits from massage therapy. *Journal of Pediatric Psychology,* 22(5), 607-617.

Sample. N= 20 (14 females, 6 males). Ages: 5.4-14.8 years, mean age = 9.8 years. Ethnicity: 40% white, 55% Hispanic, and 5% black. All children came from middle-SES families (55% nuclear families)with moderately educated parents (40% with at least some college education.

Diagnostic Criteria. Diagnosis of juvenile rheumatoid arthritis (JRA) by pediatric rheumatologist; age range between 4 and 16 years; and no other serious or chronic illness.

Baseline. One pre-treatment assessment.

Experimental Design. Randomized, controlled group outcome design.

Assessment Measures. State Anxiety Inventory (STAI); Behavior observations of the child's anxiety level by observer blind to group assignment; cortisol samples, Varni/Thompson Pediatric Pain Questionnaire-Parent Form (PPQ); parent report of child's participation in physical activities; Varni/Thompson Pediatric Pain Questionnaire-Child Form (PPQ); physician assessment of degree of pain, stiffness in joints, and number of joints affected.

Treatment protocol. Treatment 1: Massage Therapy (study specific) 15- minute massage by parents every night for thirty days. Treatment 2: PRT (Jacbsonian) parent instructed 15- minutes every night for 30 days.

Outcome. Relaxation group showed slight improvement on STAI, cortisol level, child assessment of pain, parent assessment of pain and physical activities, and physician assessment of child's pain. However, the improvement of the massage group was significantly larger on all variables.

Follow-up. No follow-up data reported.

PRT/Asthma

Field, T., Henteleff, T., Hernandez-Reif, M., Martinez, E., Mavunda, K., Kuhn, C., & Schanberg, M. D. (1998). Children with asthma have improved pulmonary functions after massage therapy. *The Journal of Pediatrics,* 132, 854-858.

Sample. N=32 (62% male, 36% Black, 50% Hispanic, 14% non-Hispanic white). Ages 4-14 years. Predominantly low to middle SES. Massage group (N=16); Relaxation group

(N=16).

Diagnostic Criteria. Asthma as diagnosed by a Physician. Subjects recruited at a pediatric pulmonary clinic. Severity of asthma based on a non-standardized system (22% mild asthma, 58% moderate asthma, 20% severe asthma.

Baseline. One pre-treatment assessment.

Experimental Design. Randomized, controlled group outcome design.

Assessment Measures. Parent report of asthma severity; Parent report of attitudes concerning asthma; cortisol level; Peak expiratory flow fates; pulmonary function tests; observed affect, anxiety, activity, and vocalizing by observer blind to hypothesis of study; Stait Anxiety Scale for Parent; State Anxiety Scale for Children.

Treatment Protocol. Treatment 1: Massage Therapy (study specific) 20 minute massage by parents every night for thirty days. Treatment 2: PRT (Jacbsonian; study specific) parent instructed 20 minutes every night for 30 days.

Results. Only significant changes for PRT group was that the parents of the children reported significantly lower anxiety levels.

Follow-up. No follow-up data reported.

Vazquez, M. I., & Buceta, J. M. (1993a). Effectiveness of self-management programmes and relaxation training in the treatment of bronchial asthma: Relationships with trait anxiety an emotional attack triggers. *Journal of Psychosomatic Research,* 37 (1), 71-81.

Sample. N= 18 (28% female). Ages: 8-13 years old (m= 10.7). Treatment group (n= 9); control group (n= 9).

Diagnostic criteria. Confirmed diagnosis of mild to moderate asthma by physician. No other nonatopic diseases or psychiatric disorders.

Experimental design. Randomized, controlled group outcome design.

Baseline. One pre-treatment assessment.

Assessment measures. Weekly asthma diary, number of asthma attack episodes, Peak expiratory flow rate (PEFR); trait anxiety portion of State-Trait Anxiety Inventory for Children (STAIC).

Treatment protocol. Treatment: Self-management (SM) program (study-specific) plus PRT (described by Bernstein & Borkovec, 1973), 6 weekly 1-hour sessions with subject and parent. Control group: SM only.

Results. Subjects in SM group showed a significant reduction in their subjective assessment of attack intensity. Children with emotionally triggered attacks in the SM + PRT group showed significant decreases in attack duration and improvements in PEFR. Improvements in both groups on STAIC.

Follow-up. No follow-up data reported.

Vazquez, I. M., & Buceta, J. M. (1993b). Psychological treatment of asthma: Effectiveness of a self-management program with and without relaxation training. *Journal of Asthma,* 30(3), 171-183.

Sample. N= 27 (30% female). Ages: 8-13 years old (m=10.8). Treatment group (n= 9); control group 1 (n= 9) and 2 (n= 9).

Diagnostic criteria. As in Vazquez & Buceta (1993a).

Experimental design. As in Vazquez & Buceta (1993a).

Baseline. One pre-treatment assessment

Assessment measures. Frequency of school absences and emergency treatment and STAIC both state and trait. All other measures are as in Vazquez & Buceta (1993a).

Treatment protocol. Treatment 1: SM only (as in 1993a). Treatment 2: SM + PRT (as in 1993a). Control: wait list.

Results. No changes in clinical or pulmonary function variables; PRT did not improve efficacy of treatment.

Follow-up. None.

Vazquez, I. M., & Buceta, J. (1993c). Relaxation therapy in the treatment of bronchial asthma: Effects on basal spirometric values. *Psychotherapy & Psychosomatics,* 60, 106-112.

Sample. As in Vazquez & Buceta (1993b).

Diagnostic criteria. As in Vazquez & Buceta (1993a).

Experimental design. As in Vazquez & Buceta (1993a).

Baseline. One pre-treatment assessment.

Assessment measures. Emotional trigger interview. All other measures as in (1993b).

Treatment protocol. Treatment 1: SM only (as in 1993a). Treatment 2: SM + PMR (as in 1993a). Control: wait list.

Results. No change in pulmonary function variables post-relaxation. Self report of State anxiety did decrease in both treatment groups but more in group with PMR as a treatment component.

ADHD

Field, T. M., Quintino, O., Hernanez-Reif, M., & Koslovsky, G. (1998). Adolescents with Attention Deficit Hyperactivity Disorder benefit from massage therapy. *Adolescence,* 33, 103-108.

Sample. N= 28 (100% male, mean age= 14.6) recruited from self-contained classrooms for emotionally disturbed adolescents. Ethnicity and SES: (71% white, 29% nonwhite Hispanic; 90% middle SES).

Diagnostic Criteria. Diagnosis of ADHD according to DSM-III-R criteria.

Baseline. One pre-treatment assessment.

Experimental design. Randomized and stratified, controlled group outcome design.

Assessment measures. Happy Face Scale; Center for Epidemiologic Studies Depression Scale (CES-D); The Empathy Scale; Conners Ratings Scales.

Treatment protocol. Treatment 1 (massage therapy, study specific), one 15-minute massage per day after school for 10 consecutive school days. Treatment 2 (PRT, non-specified procedure), one 15-minute relaxation session per day after school for 10 consecutive school days.

Results. No changes were noted on any of the assessment measures for the relaxation therapy group.

Follow-up. No follow-up data reported.

PRT/Depression

Field, T., Grizzle, N., Scafadi, F., & Schanberg, S. (1996). Massage and relaxation therapies' effects on depressed adolescent mothers. *Adolescence,* 31, 903-911.

Sample. N= 32 adolescent females (N= 18.1). Ethnicity: 71% black and 29% Hispanic. Average years of education was 10.4. Subjects had all recently given birth at a larger inner-city hospital and were recruited from the hospital's maternity ward.

Diagnostic criteria. Elevated score on the Beck Depression Inventory (BDI) and free of current medication or any other treatment for depression or related disorders.

Baseline. One pre-treatment assessment.

Experimental design. Randomized, controlled group outcome design.

Assessment measures. Behavior Observation Scales; Profile for Mood States (POMS); State Anxiety Inventory for Children (STAIC); pulse rate; saliva samples of cortisol; urine sample for cortisol.

Treatment Protocol. Treatment 1 (massage therapy, study specific), one 30-minute massage per day on two consecutive days per week for five consecutive weeks. Treatment 2 (relaxation therapy, yoga and PRT, study specific) 30-minute relaxation therapy sessions on two consecutive days a week for five consecutive weeks.

Results. The only statistically significant outcome for the relaxation therapy group was a lower score on the STAIC following the first day of relaxation training.

Follow-up. No follow-up data reported.

Kahn, J. S., Kehle, T. J., Jenson, W. R., & Clark, E. (1990). Comparison of cognitive-behavioral, relaxation, and self-modeling interventions for depression among middle-school students. *School Psychology Review,* 19(2), 196-211.

Sample. N= 68 (49% male). Ages: 10-14 (17 sixth-graders, 29 seventh-graders, 22 eighth graders). Subjects were recruited from the entire student population of a large suburban middle SES neighborhood. Seventeen subjects in each of the 4 groups.

Diagnostic criteria. A multistage-multimethod assessment model was used to identify

those students who displayed a high degree of depressive symptomatology

Baseline. One pre-treatment assessment.

Experimental Design. Randomized and stratified, controlled group outcome design.

Assessment measures. Reynolds Adolescent Depression Scale (RADS); Bellevue Index of Depression (BID); adapted version of the Children's Depression Inventory (CDI); Piers-Harris Children's Self-Concept Scale; parent-report RADS and parent-report CDI.

Treatment Protocol. Treatment 1 (cognitive-behavioral treatment based on Clarke and Lewinsohn, 1984) 15 2-hour sessions held twice weekly. Treatment 2 (relaxation training combing PRT, imagery, and breathing; study-specific) 12 sessions of unspecified length covering an unspecified amount of time. Treatment 3 (Self-modeling, study specific) 10 to 12 minute sessions conducted twice weekly for 6 to 8 weeks. Fourth group was a wait list control.

Outcome. All treatment groups, relative to the control group showed a significant decrease in depression and an increase in self-esteem. The cognitive-behavioral group showed the most improvement followed by the relaxation group and lastly the self-modeling group. Also, nearly all of the subjects in the treatment groups (98%) rated their respective intervention programs as at least "somewhat helpful." and every subject rated their treatment as at least "somewhat enjoyable."

Follow-up. Treatment gains were maintained at 1-month follow-up. This is mostly true for the cognitive-behavioral and relaxation groups where the majority of subjects remained in the functional range. As many as 50% of self-modeling subjects fell back into the dysfunctional range at follow-up.

Wood, A., Harrington, R., & Moore, A. (1996). Controlled trial of a brief cognitive-behavioural intervention in adolescent patients with depressive disorders. *Journal of Child Psychology and Psychiatry*, 37(6), 737-746.

Sample. N= 53 (62% female). Ages: 9-17. Subjects were outpatient referrals to a clinic that specialized in treatment of depression. Treatment group (N= 24). Control (PRT, N= 24).

Diagnostic criteria. Subjects had to have a DSM-III-R diagnosis of major depressive disorder (MDD) or RDC minor depression and a Mood and Feelings Questionnaire (MFQ) of 15 or more. Subjects needed to be in the age range of 9-17 years old. Subjects with psychotic disorder; inpatients taking or likely to require antidepressants; children with autism; children unable to complete the questionnaire; children attending a special school because of learning problems; or children with a major physical illness were

excluded.

Baseline. One pre-treatment assessment.

Experimental design. Randomized, controlled group outcome design.

Assessment measures. The Mood and Feelings Questionnaire (MFQ); The revised Children's Manifest Anxiety Scale (RCMAS); The self-esteem scale of Warr and Jackson (WJS); conduct problems over a 3 month time-period as rated on the Antisocial Behaviour Scale (ABS); questionnaire measure of expectancy of treatment. Parallel versions of all of these measures were completed by the children's parents.

Treatment protocol. Treatment: Depression Treatment Programme (DTP) (study-specific). Control: PRT (based on Bernstein & Borkovec, 1973). Treatment lasted from 5-8 sessions with no difference between groups.

Results. Both groups showed improvement in all symptomatology. The cognitive-behavioral group showed a greater improvement on measures of both depression and overall outcome. However, there were no differences between the treatments on comorbid anxiety and conduct symptoms.

Follow-up. Both groups were still improved at 3 and 6 month follow-up. However, differences between the two groups were greatly reduced at 3 month follow-up and non-existent at 6-month follow-up.

PRT/ Headaches

Engel, J. M. (1993). Children's compliance with progressive relaxation procedures for improving headache control. *The Occupational Therapy Journal of Research,* 13(4), 219-230.

*Sample. N= 10 (*8 females, 2 males). Ages: 9-15 years (M=11.5 years). Ethnicity: 1 Hispanic and 9 Whites all middle to upper SES.

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

Baseline. Seven to twenty-five days.

Experimental Design. Multiple Baseline across subjects.

Assessment Measures. Headache diary, recorded daily; pill counts; relaxation training log;

unannounced phone calls.

*Treatment protocol. PRT (*based on Bernstein & Borkovec, 1973) during 6 weekly sessions. Then they were given a relaxation tape to practice at home. A secret password was recorded each day in the mid-point of the tape.

Outcome. Significant decreases in multiple headache indices for 8 out of 10 subjects. Mean compliance to treatment
regimen across subjects was 84%. Noncompliance was higher on headache free days and on Friday through Sunday.

Follow-up. No follow-up data reported.

Kroner-Herwig, B., Mohn, U., & Pothmann, R. (1998). Comparison of biofeedback and relaxation in the treatment of pediatric headache and the influence of parent involvement on outcome. *Applied Psychophysiology and Biofeedback*, 23(3), 143-157.

Sample. N= 50 (60% female). Ages: 8-14 (m= 10.96). Referred for treatment by a neuropediatric specialist at a general hospital. Ten children in each condition.

Diagnostic Criteria. Children were included in the study if they were between 8 and 14 years old, had at least two headache episodes in the previous month, and had no somatic etiology that would demand an alternative intervention.

Baseline. Four week headache diary to monitor headache occurrence.

Experimental design. Randomized, controlled group outcome design.

Assessment measures. Headache diary, recorded daily by child to assess frequency, duration, and intensity of headaches; headache diary kept by parents (pre-post).

Treatment protocol. Treatment 1: (PRT; study-specific, included music and imagery), six individual sessions of 1 hour duration each, weekly. Treatment 2: (biofeedback; study-specific, included imagery), 12 individual biofeedback sessions of 30 minutes duration two times per week. There were also two parent involvement (PI) conditions, one for each treatment group (study-specific). Control: self-monitoring waiting list control.

Outcome. About half of the PRT group had a clinically relevant improvement. This improvement was not as high as the biofeedback group. Four out of ten children showed clinically relevant improvement in the self-monitoring control group but this improvement was not as large as any of the treatment groups. Parent involvement made no difference regarding outcome in either treatment condition.

Follow-up. Reduction of frequency, intensity, and duration of headaches was even more pronounced at 6-month follow-up for both PRT and biofeedback conditions.

Larsson, B., Melin, L., & Doberl, A. (1990). Recurrent tension headaches in adolescents treated with self-help relaxation training and a muscle relaxant drug. *Headache,* 30, 665-671.

Sample. N= 48 (90% female). Ages: 16-18.

Diagnostic criteria. Subjects were high school students who had a headache history of at least one year and a headache frequency of more than once per week. Diagnosis was made by students filling out a standardized headache inventory.

Experimental design. Randomized, controlled group outcome design.

Baseline. One three week period.

Assessment measures. Headache diary; headache questionnaire; somatic checklist; modified form of the Children's Manifest Anxiety Scale using a 4 point scale; Beck's Depression Inventory (BDI); 11 point inventory developed to measure the experience of stress in life using a 4 point scale.

Treatment protocol. Two thirds of subjects were randomized into treatment group. One third of the sample were placed on waiting list and received the identical treatment procedure 5 weeks following the beginning of the first group's treatment.. Treatment components were administered over 5 weeks periods. The first time period consisted of PMR (based on Bernstein and Borkovec, 1973) used by the child alone with the assistance of a treatment manual and 5 audiotapes. The second 5 week time period consisted of approximately one-half of the treatment group (N= 16) a receiving prophylactic pharmacological treatment (chlormezanone) while the other half (N= 15) received a placebo. The drug-placebo conditions were reversed among subjects in the next 5 week period.

Results. It was found that subjects rated PMR has a more highly credible treatment than medication. Subjects in treatment group improved at a statistically significant rate compared to the control group on headache frequency and headache-free days. However, the majority of the subjects (80.6%) did not reach a level of clinically significant improvement. Statistically significant improvements were found in all subjects receiving PMR on measures of somatic symptoms, depression, anxiety, and stress.

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

Passchier, J., Van den Bree, M. B. M., Emmen, H. H. Osterhaus, S. O. L., Orlebeke,

J. F., & Vergage, F. (1990). Relaxation training in school classes does not reduce headache complaints. *Headache,* 30, 660-664.

Sample. N= 202 (49% female, mean age= 13.6). Treatment group (n= 110); control group (n= 92). 19 classes in three secondary schools located in a medium-sized town and a larger city. Schools varied in the average SES of students.

Diagnostic Criteria. Students in the three classes who reported at least one headache in the past three weeks were included in the study.

Baseline. None specified.

Experimental Design. Randomized, controlled group outcome design.

Assessment Measures. Headache diary; Hermanns' Subscale for Dehabilitating Anxiety of the Achievement Motivation Test (PMT-K) for Children; self-report of school problems; self-report of the training experience.

Treatment protocol. School-based intervention administered by psychologist trained physical education teachers. Two groups: (1) progressive relaxation training (PRT), ten 20 to 10 minute sessions (based on Bernstein and Borkovec, 1973); (2) placebo training (PT) control group, ten 20 to 10 minute sessions of "physical concentration exercises."

Outcome. No significant differences were found between groups on any of the outcome measures regarding headache frequency, duration and intensity and the psychological variables.

Follow-Up. No follow-up data reported.

Sartory, G., Muller, B., Metsch, J., & Pothmann, R. (1998). A comparison of psychological and pharmacological treatment of pediatric migraine. *Behaviour Research and Therapy,* 36, 1155-1170.

Sample. N= 43 (40% female). Ages: 8-16 (m= 11.3). Subjects recruited from out-patient clinic of a pediatric hospital and through advertisements in local newspapers and radio broadcasts.

Diagnostic criteria. Subjects had to meet the International Headache Society (IHS) criteria for headache and were diagnosed by one of the authors of the study, a pediatrician. The minimal duration of the disorder had to be 6 months with at least two attacks taking place during the last month. Children or adolescents with secondary headache and those

with a neurological or developmental disorder were excluded.

Baseline. Four weeks

Experimental design. Randomized, controlled group outcome design.

Assessment measures. Headache diary, recorded daily.

Treatment protocol. Treatment group 1: pharmacological treatment (Metoprolol, either a 50 mg or 40 mg daily dose depending on weight of the child), children seen weekly by physician, medication withdrawn at the end of 10 weeks. Treatment group 2: Cephalic vasomotor biofeedback, consisting of 10 individual sessions, twice weekly during the first four weeks and single weekly sessions during the remaining two weeks of treatment. Treatment 3: PRT (study-specific), 10 individual sessions, twice weekly for first four weeks and single weekly sessions during last two weeks. Both psychological treatment groups also employed a stress-management training component (based on McGrath et al., 1992).

Outcome. PRT combined with the stress management training was significantly more effective in reducing headache frequency and intensity than metoprolol. PRT was also more effective than biofeedback.

Follow-up. Results were stable at 8-month follow-up.

PRT/Tourette Syndrome

Peterson, A. L., Azrin, N. H. (1992). An evaluation of behavioral treatments for tourette syndrome. *Behaviour Research and Therapy, 30*(2), 167-174.

Sample. N= 6 (two subjects under 18; both male). Ages: 10 & 13. Recruited from the Tourette Syndrome Association and from newspaper articles.

Diagnostic Criteria. Diagnosis of Tourette Syndrome by physician. Subjects also met DSM-III-R criteria for Tourette's Disorder.

Baseline. 4 blocks of 2.5 minutes each.

Experimental design. Counterbalanced within subjects, AB design.

Assessment measures. Frequency of tics as measured by research assistants watching a videotape of the subjects.

Treatment protocol. Data were collected over three clinic visits each spaced two weeks

apart. Each treatment lasted 30 minutes. Treatment 1: Self-monitoring (study-specific). Treatment 2: PRT (based on Bernstein & Borkovec, 1973). Treatment 3: Habit reversal (based on Azrin & Peterson, 1988).

Results. Tics were reduced by all three of the treatments. Overall, PRT was the least effective intervention of the three with an average tic reduction of 32%. However, this varied between subjects. For the two subjects under 18 the tics of the 13-year-old were reduced only 2% by PRT, conversely the tics of the 10-year-old were reduced 50% by PRT.

Follow-up. No follow-up data reported.