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Progressive Muscle Relaxation as an Adjunctive Treatment for Moderate Asthmatics

Kellye Hutton Slaggert

Western Michigan University

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PROGRESSIVE MUSCLE RELAXATION AS AN
ADJUNCTIVE TREATMENT FOR
MODERATE ASTHMATICS

by

Kellye Hutton Slaggert

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
August 1990
PROGRESSIVE MUSCLE RELAXATION AS AN ADJUNCTIVE TREATMENT FOR MODERATE ASTHMATICS

Kellye Hutton Slaggert, M.A.
Western Michigan University, 1990

This study examined the effects of parent assisted progressive muscle relaxation (PMR) training on moderate asthmatics. Three children between the ages of 7 and 12 participated in the study. After 3 weeks of PMR training and daily practice, the parents became involved in prompting their children to use PMR when an attack appeared likely.

The findings from this study suggest that parental prompting of PMR was instrumental in decreasing the frequency of attacks, increasing peak expiratory flow rates (PEFR) values, and decreasing the severity of attacks for 2 of the 3 subjects. The long term implications for using PMR as an adjunctive treatment do look promising for moderately asthmatic children.
ACKNOWLEDGEMENTS

I would like to express my appreciation to Dr. M. Michele Burnette for her input, helpfulness and availability during the course of this study. I would also like to acknowledge Dr Douglas Homminick and his assistant Marsha Girolmi for their time and helpful input regarding subject recruitment. Most of all, I would like to thank my best friend, Jeff Slaggert, for his endless support and patience during the course of the study.

Kellye Hutton Slaggert
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INTRODUCTION

Asthma is typically defined as the intermittent, reversible obstruction of the airways. Creer (1978) highlights the importance of each word in that definition. It is intermittent in that an attack can occur at any time, variable because an attack can occur on a continuum from mild to status asthmaticus and, finally, reversible because the condition can revert back to normalcy either spontaneously or with adequate treatment. Clinical manifestations of asthma include wheezing, chest tightness, breathlessness or cough. Air flow obstruction results from smooth muscle constriction, intraluminal secretions, bronchial edema and inflammation. These factors alone or combined contribute to the narrowing of the air passages, making breathing difficult and contributing to the "wheezing" sounds characteristic of asthma. This wheezing sound is produced much in the same way as the sounds from a reed instrument. Musical sounds are produced by air moving through a narrow orifice (Wagener, 1986).

Lung pathology can occur at two different loci: central or larger airways and peripheral or smaller airways including alveoli (Alexander, Cropp, & Chai,
1979). Regardless of what precipitates an attack, there are predictable physiological changes leading to obstruction of airflow.

There are many different theories regarding the etiology of asthma, but at the present time there is no one theory which adequately explains all of the components of asthma. Part of the difficulty in understanding the physiological mechanisms of asthma is its multidimensional etiology. Heredity, allergies, respiratory infections, and environmental factors contribute to asthmatic symptoms (King, 1980). According to Rackemann's classification system (1928), asthma can be divided into extrinsic or intrinsic subclassifications, according to suspected etiology. Extrinsic asthma is mediated by immunological factors. Allergens such as pollen, dog dander, mold, dust, chemicals, foods and odors all may induce attacks. A label of intrinsic asthma is assigned for those cases with no known immunological basis for their attacks. Examples of non-specific, non-allergic stimuli which may precipitate attacks are: exercise, environmental irritants, idiosyncratic reactions to aspirin and metabisulfites, laughter and stress (Weiner, 1987).

Asthma symptoms can have serious consequences. In a few extreme cases the airways may become blocked to the extent that no air can reach the lungs. Severe asthmatic
attacks can result in death if proper pharmacological treatment is not implemented. In a review conducted by Nguyen, Patterson and Sly (1985), there were seven asthmatic deaths at the Children's Hospital National Medical Center in Denver, Colorado, between 1941 and 1971; none was reported after 1971 despite increased admissions. However, according to another source, asthma does account for about 4,000 deaths per year (Davis, 1972). Synder, Winder, & Creer (1987) contend that irreversible asthma is caused primarily by delays in implementing appropriate therapy and under treatment of asthma. Status asthmaticus, acute and irreversible asthma, does still occur today but is not a major threat for asthmatic children due to increased medical knowledge.

Three million American children currently suffer from asthma (Blessing-Moore, Fritz, & Lewiston, 1985). Not only do asthmatics suffer physically from this disease, but they also suffer in other ways which are less obvious. The asthmatic child has a school absenteeism rate of 8.5% compared with 5.9% for the non-asthmatic (Parcel, 1979). Consequently children with severe asthma were as much as one year behind in academic achievement. Not only does the asthmatic child begin to fall behind his or her peers in academics, but social growth may also be markedly delayed.

Additionally, families of asthmatics suffer a great
financial burden from hospital stays, visits to the physician and prescription drugs. In 1984 asthma accounted for 4.7% of all hospitalizations for children in the United States according to a U.S. National Health Survey (1984). A recent survey of pediatricians revealed that approximately eighty-one patients with respiratory problems were seen per pediatrician per week (Blessing-Moore et al., 1985). Creer (1978) reported that in the United States, during 1975, 224.2 million dollars was spent on bronchodilators, 24.7 million dollars on corticosteroids and 43 million dollars on over the counter asthma remedies. Out of 50 selected families, the direct and indirect cost of asthma ranged from .35 to 33% of the family's income (Marion, Creer, & Reynolds, 1985; Vance & Taylor, 1971). The financial stress of having an asthmatic child is likely to lead to considerable family disharmony. For those families with low incomes, the costs of asthma may be socially devastating.

Family dynamics may also suffer when a member is asthmatic. Sick children tend to receive more attention than their siblings from the parents. Sibling relationships may suffer as a result. Activities in which the entire family engages may be restricted due to the physical limitations of the asthmatic.

All of the above factors highlight the importance of treatment and coping skills for those with asthma.
Effective management is critical for any chronic disease, asthma being no exception. Efficacious management might allow the asthmatics to live fuller lives. For example, effective coping skills should diminish the problems in academics, social and family life. In addition, coping skills which are taught early in life are likely to develop into established healthy patterns of behavior. This may decrease the number of school days missed and, later in life, sick days from work. Furthermore, as the coping skills become more refined in adulthood, the financial costs of asthma may be reduced.

Respondent and operant behavioral paradigms can be used to account for the acquisition and maintenance of asthmatic behavior. Asthmatic behaviors may become respondently conditioned if specific environmental stimuli, neutral stimuli, are repeatedly paired with the unconditioned stimulus (ucs) which elicit an attack. For example, dog dander is an allergen for some asthmatics. Because the dog dander is repeatedly paired with the presence of a dog, a neutral stimulus, the dog may acquire properties of a conditioned stimulus (cs). The dog as a cs may then elicit an attack in the absence of the ucs or the dog dander.

Operant conditioning may play a role as well. Environmental stimuli which precede and follow asthmatic behavior may maintain asthmatic symptoms. For example,
asthma attacks may be followed by the avoidance of an unpleasant task or increased social attention following symptoms of sickness. Thus asthma attacks may be maintained through positive and negative reinforcement. The topography of respondent or operant asthmatic behavior is nearly identical to the asthma attacks resulting from biological bases.

Several studies have demonstrated the effectiveness of environmental control of asthma symptoms. Creer (1970), for example, used time out procedures to dramatically reduce the duration and frequency of hospitalizations for asthmatic symptoms. Two young asthmatic boys, who were suspected of malingering, residing at the Children's Asthma Center participated in this study. Physicians responsible for admitting or discharging subjects were blind to experimental conditions as admission was based upon the severity of the attack. A single-subject reversal design was used to examine the effects of the time out procedure. The amount of attention and special treatment the subject received while being hospitalized was reduced during the time out phase of the study. For example, television, visitors and eating with others, which were allowed in previous hospitalizations and baseline, were all strictly forbidden during treatment conditions. Additionally, the only books allowed in the rooms were school text books.
During baseline, subject 1 had 16 hospital admissions totaling 28 days. After the second treatment phase, these rates decreased to 2 admissions totaling 4 days. Subject 2 had 10 admissions during baseline totaling 23 days and an evidenced decrease to 2 admissions totaling 3 days following treatment. This study illustrates the effect of time out procedures in reducing the frequency and duration of asthma attacks. Neisworth (1972) conducted a study which suggested operant control of asthmatic behavior. The subject was a 7-year-old asthmatic who had exhibited severe asthma almost continually throughout his life. It was hypothesized that the subject's sick behavior, which seemed to increase at bedtime, was reinforced with verbal and tactile attention from the parents. Two systematic, simultaneous treatments were implemented. The first consisted of removing parental attention once the subject was placed in bed. Supplementing this extinction was reinforcement of incompatible behavior; if the subject coughed less frequently during the night, a highly desirable activity was permitted the following day. During baseline his attacks averaged 68 minutes; following treatment the duration of his attacks decreased to 29 minutes. An 11-month follow-up after intervention revealed no increase in asthma behaviors. This study illustrates how parental extinction of asthmatic behavior is effective in decreasing the
length of asthma attacks. From this study it is logical that the frequency of asthma attacks may also decrease under parental extinction.

Another study (Purcell et al. 1969) demonstrated environmental control of asthmatic behavior. Parents of 25 chronic, severe asthmatics were interviewed for possible emotional precipitants of asthma symptoms. Subjects were then divided into two groups: (1) those with emotional factors appearing clinically relevant to asthma (predicted positive responders), and (2) those where emotional factors appeared less relevant (predicted negative responders). The study hypothesized that family members reinforced asthmatic behavior and that improvements would occur during the separation of the family from the asthmatic. To test this hypothesis, the families agreed to leave the home for two weeks leaving the asthmatic with a surrogate parent. After baseline data on pulmonary physiology, medical requirements and frequency of attacks were collected, the families were moved out of their homes. Upon comparing all dependent variables, there was a statistically significant decrease in asthmatic behavior during the intervention in the predicted positive group. Not only was there a decrease of the many asthmatic measures during the separation, but two weeks following the reunions of the families, the children exhibited a sharp increase in asthmatic
symptoms. They concluded that families may inadvertently maintain asthmatic symptoms through parental attention. However, given the lack of control used in their research, this conclusion may have been premature.

The primary weakness in this intervention is its impracticality. It would be more reasonable to work directly with families of asthmatics to reduce inadvertent reinforcement of asthmatic behavior by the family. By training parents to differentially reinforce healthy behaviors while minimizing attention for sick behaviors, a reduction in asthma symptoms may be gained without having to engage in measures as drastic as moving the family out of the household for 2 weeks. Additionally, the effects seen from the separation were not permanent. Upon return, the environmental factors maintaining asthma symptoms were restored and asthma symptoms nearly reached pre-separation rates. Thus, directly changing the parents' behaviors (environmental factors) as they relate to maintenance of asthmatic symptoms may be more likely to have a long term effect on the asthmatic.

In addition to decreasing the reinforcement provided by parents, relaxation therapy may also be an ideal technique to use in the self management of asthmatic behavior. After detecting early indicators of a pending asthma attack, relaxation could commence and counteract or diminish the impact of the precipitating stimuli.
The narrowing of airways in asthma can occur from smooth muscle constriction. Additionally, asthma attacks themselves may increase muscle tension in the asthmatic. Initiating relaxation may interrupt the typical sequencing of events leading up to an attack and allow for reconditioning to occur.

Relaxation skills may also allow the asthmatic to cope better with this disease by introducing an element of self control where previously asthmatic symptoms were uncontrollable. Early research by Alexander, Miklich, & Hershkoff (1972) indicated that systematic relaxation techniques were effective in helping children cope with asthma. Eighteen male and female asthmatics, matched for age, severity, and sex were divided into two groups. One group received 3 sessions of modified Jacobsonian systematic relaxation and the other group was told to sit quietly and relax. Subjects who were taught relaxation were instructed to practice 15 minutes before bed. Peak expiratory flow rates (PEFR), taken before and after each session indicated that relaxation resulted in a significant increase in PEFR values over the control group. Secondly, there was dramatic improvement in PEFR readings from the first relaxation session to the last session. Alexander et al. (1972) concluded that "meaningful symptomatic improvement could result from the deliberate self employment of previously learned relaxation induction"
during an asthma attack" (p. 392).

However, a later study conducted by Alexander et al. (1979) failed to demonstrate any clinically significant effects from relaxation training when using more sensitive measures of pulmonary functioning as the dependent variable. The study followed 14 chronic, severe asthmatics who received 3 sessions of relaxation training. The benefits gained from relaxation were not found to be clinically significant despite statistical significance. However, 3 sessions of relaxation training is a minimal level of intervention. Studies similar to this have yet to be conducted with the mild-moderate sub-population of asthmatics.

Sirota and Mahoney (1974) trained a middle-aged woman to relax on cue whenever she felt an attack was pending. Several environmental precipitants of asthmatic attacks were identified as conditioned stimuli from a behavioral interview. A portable timer was carried at all times. If the conditioned stimuli were present, the timer would be set for 5 minutes and relaxation procedures implemented. Nebulizer use could only occur after the 5 minutes if there was still a need. Self report data revealed a large decrease in nebulizer use. The results of this case study suggest that precipitants can be identified and that if relaxation procedures are implemented soon enough they can have an impact on coping
with asthma. Differential reinforcement of relaxation responses, incompatible behavior to asthmatic symptoms, used at the onset of an asthma attack could have significant effects.

Another study compared the effects of relaxation and biofeedback-assisted relaxation with a no treatment control (Davis, Saunders, Creer, & Chai, 1973) in severe and non-severe asthmatics. Subjects in all three groups were matched for age and asthma severity. Severe asthma was defined as dependency upon steroids for management. The dependent measure was the degree of relaxation as indicated by low microampere readings. Treatment, following an 8-day baseline, consisted of five, 30-minute sessions. Non-severe asthmatics were found to have a greater decrease in airway resistance than the severe asthmatics. This study suggests that the mild-moderate population of asthmatics may be more responsive to relaxation techniques than those with severe asthma.

The present study used progressive muscle relaxation as an incompatible behavior for parents to reinforce. The procedures required that coping behaviors be reinforced by the parents rather than sick behavior. Parent Assisted Relaxation Training, P.A.R.T., was used and consisted of having the parent cue the child to relax when an attack appeared imminent.

This study improved on the previous research in a
number of ways. The first improvement was the inclusion of 7 training sessions and the addition of daily home practice in teaching progressive muscle relaxation (PMR), as outlined by Bernstein and Borkovec (1973). This allowed ample opportunity for the technique to be learned. The study by Alexander et al. (1972) was the only relaxation study which mentioned home practice requirements. This skill is like any other skill; practice is required for adeptness. In the studies which did not employ practice, it is hard to ascertain if the subjects were exposed to relaxation to the point of proficiency. Hence, negative outcomes could be the direct result of lack of skills in the subjects.

Secondly, this study examined mild to moderate asthmatic children. Children with severe asthma have many physiological factors to overcome when using relaxation as a means to improve breathing. It was expected that children with mild to moderate asthma would find relaxation training more beneficial in coping with this disease.

Finally, the last improvement consisted of using several dimensions of asthma attacks as dependent variables in assessing the outcomes of the study. Changes in severity of attacks after interventions have been largely ignored by previous studies. Inhaler use is another important dimension of asthma attacks which was
considered in the present study. Inhaler use was predicted to be highly correlated with frequency of attacks, as inhalers are typically used at the onset of an attack and hence sensitive to treatment effects. P.A.R.T. application may negate the use of an inhaler. Thus successful P.A.R.T. application was defined as "PMR application at the onset of an attack which did not require inhaler use after implementation of PMR." Frequency of asthma attacks and PEFR values were also dependent measures in this study.

It was hypothesized that relaxation skills coupled with parental prompting for application of these skills would be effective in decreasing the frequency of asthma attacks, improving PEFR values, decreasing the severity of attacks and decreasing inhaler use in children with perineal, non-severe, asthma.
METHOD

Subjects

The subjects were 3 children, 2 male and 1 female, between the ages of 7-12. All subjects met the criteria established in defining mild to moderately asthmatic symptoms: stabilized medical management and supervision, daily symptoms of asthma, and who were willing to commit to the time requirements of the program. Children with other major illnesses, psychological problems or who were prone to respiratory infections exacerbating asthma were excluded from this study (Appendix A). A local pediatrician aided in the recruitment of subjects by sending letters outlining the study to qualified patients and their parents.

Setting

Relaxation training was conducted in a sound-attenuated, dimly lit room where the likelihood of distractions was slight. The room was equipped with a one-way mirror so the parents could observe the relaxation training if they desired. The subjects sat in a comfortable chair which completely supported their bodies and allowed them to remain in an upright position as this has been
found to increase pulmonary functioning in asthmatics (Alexander et al. 1979).

**Apparatus/Materials**

The Glaxo Assess flow meter was used to determine degree of pulmonary functioning. This is a small, lightweight instrument which consists of two detachable parts, a mouth piece and a meter component. Proper use of this instrument entails connecting the two parts and blowing as hard as one can into the mouthpiece. The force of this air provided information on pulmonary functioning in liters per second; the less the obstruction in the airways the greater the peak flow value.

A portable EMG module, Autogenics AT 33, was used to assess acquisition of relaxation skills during the relaxation training sessions. Silver chloride disposable electrodes were used in obtaining the frontalis recordings.

Additionally, various rewards were given out 3 times during the study with the intent of maximizing subjects' effort and cooperation. Subjects' effort in peak flow values, practice of relaxation skills, and completion of the study were rewarded with games, cars, or musical tapes, along with activities young children typically enjoy. It was assumed that these would function as reinforcers for the children.
Procedure

Potential candidates were first screened through a telephone interview. Eligible and interested candidates were then asked to come in for a family meeting during which more information was obtained regarding the history and the nature of each child's asthma (Appendix B) and consent forms were signed (Appendix C). If the subject met the criteria and signed the consent form, the following occurred: Each subject was given a peak flow meter and instructed in its proper use. Subjects were instructed to take measures of pulmonary functioning two times daily, morning and evening, during the three week baseline and for the duration of the study. Due to the effort-dependent nature of peak flow values, all subjects were informed of the (pseudo) contest with one another for the highest peak flow value. Since all children participating received a prize for doing their best on peak flow values, this "contest" was to maximize the subjects' efforts in peak flow readings. Home readings were initialized by a parent to eliminate possible exaggeration of values.

During the family meeting, child participants were informed of the two other opportunities they had to earn prizes. Regular daily practice of relaxation would enable each child to participate in a highly desirable yet reasonable activity. The participants were asked to
sign a contract (Appendix D) agreeing to daily practice of relaxation skills. Next, parents and children selected an activity which was mutually satisfactory. Participation in this activity was allowed if relaxation was practiced according to the contingencies described in the behavioral contract. Finally, all subjects who completed the program were given a certificate of completion along with a prize one month after the last PMR training session.

Index cards for daily recording of frequency and location of asthma attacks were given and explained to the children and parents during this first meeting (Appendix E). Participants were then instructed to record each asthma attack on the index card immediately following each attack. Weekly phone contacts were made to each participant during the study as a reminder to mail daily recording forms each week.

Following baseline, relaxation training began. Relaxation training modeled Bernstein and Borkovecs's (1973) method of progressive muscle relaxation. To guard against boredom the number of sessions used for each muscle group was modified slightly; 2 sessions with 16 muscles, 1 with 7 muscle groups, 1 with 4 muscle groups, 1 session of recall, 1 session recall and counting, and 1 session of counting (Appendix F). Imagery was introduced into the relaxation pattern to further facilitate the
relaxation process for each subject. Thoughts of lying on a warm beach and other relaxing activities previously experienced by the subject were elaborated on in detail during the patter to keep them on task. The recommended relaxation pattern length was also shortened from 45 seconds to 30 seconds.

Electromyograph measures were taken to assess each subject's ability to relax before relaxation training. EMG measures were taken while each subject sat quietly for 5 minutes. Next each subject was instructed to try to relax for another 5 minutes to assess each subject's ability to relax prior to the training. Electromyograph measures were also taken before and after the first, fifth and final PMR sessions to determine if relaxation skills were learned by the subject. Only after the last PMR training session were subjects given feedback on their EMG measures.

Daily practice was instructed of all subjects once treatment had commenced. After the first sessions of PMR, behavioral contracts (Appendix D) were signed by both the parents and the child to increase the probability of home practice. Handouts summarizing the relaxation skill and describing necessary practice conditions were also provided for the parents and child (Appendix G).

While learning the PMR skill, all subjects were
instructed not to use the skill at home other than during practice. The fact that application of the PMR skill during an asthma attack, once it has been mastered, is less likely to fail than if it is used prior to mastery was strongly emphasized to the subjects and their parents. Professional assistance when applying the skill would begin after the completion of the PMR sessions.

Following completion of PMR training, P.A.R.T. (Parent Assisted Relaxation Training) began. P.A.R.T. (Appendix H) was aimed at getting the parents to teach their child relevant applications of PMR. The parents were instructed to surprise their child with practice sessions 2 to 3 times during the week. Individualized cue phrases were used by the parent to signal the onset of the drill. The child was then instructed to instantaneously utilize his/her newly acquired PMR skills. These practice sessions were done randomly and in many different situations. Parents were also instructed to prompt their child to use PMR if an asthma attack appeared imminent after two successful practice sessions. Detailed reports of practice sessions along with relevant applications were provided by the parents during the weekly phone contacts. Daily recording and P.A.R.T. continued 1 month after the treatment phase. Participants were then given a certificate announcing their completion of the program along with a small prize.
Dependent Variables

**Frequency of Attacks**

Frequency of asthmatic attacks were used as one indicator of success. The average number of asthma attacks per week during baseline was compared with the average number of attacks per week after treatment. In addition to pre-post comparisons, percent change scores were calculated for each subject using the following formula: \(100 \times (\text{Post/Pre} - 1)\). The average number of attacks pre- and post-treatment were then used to calculate the percent change.

**Peak Expiratory Flow Rates**

Peak flow rates were also examined for pre- and post-treatment differences. Expected peak flow values were determined for each subject using a chart prepared by Polgar and Promadhat (1971) (Appendix I). Comparisons were then made between average treatment peak flow values and the child's expected peak flow values. Average weekly baseline PEFR values were also compared with average weekly post-treatment PEFR to assess treatment effects of relaxation training on pulmonary functioning. Percent change was calculated in the same manner as outlined in frequency of attacks.

Pearson's correlation coefficient was used to
determine the correlation between PEFR values and frequency of attacks. Higher PEFR values, indicating improved pulmonary functioning, were predicted to be negatively correlated with frequency of attacks.

Severity of Attacks

Each asthma attack was rated by the subject on a scale from 1 to 3; 1=mild, 2=moderate, and 3=severe. Average severity values were obtained for both baseline and post-treatment conditions in the assessment of decreased severity for each subject. Percent change from pre- to post-treatment was also calculated for each subject using the formula outlined above.

Inhaler Use

Finally, the relationship between inhaler use and frequency of attacks was examined. Pearson's correlation coefficient was used in obtaining the correlations between frequency of attacks and inhaler use pre- and post-treatment. A high positive correlation between number of attacks and inhaler use was predicted. Number of weekly attacks was correlated with frequency of weekly inhaler use in compiling the pre- and post-treatment comparisons.
Research Design

A multiple baseline design across subjects was used to demonstrate the effectiveness of reinforcing relaxation as an incompatible response. The baseline of each subject was staggered by 2 or 3 weeks to allow independent replication of the treatment's effect upon each of the dependent variables.
RESULTS

Reliability

The primary investigator tabulated all the data from the daily recording forms on a weekly basis. Number of attacks per day, weekly average frequency of attacks, average weekly PEFR values, and average weekly severity of attacks were all compiled for each subject weekly. For inter-observer reliability every other week's data, or fifty percent, was scored by a second person unrelated to the study. Inter-rater reliability, computed as number of agreements/number of agreements and disagreements multiplied by 100, was 93%.

Progressive Muscle Relaxation

Figure 1 displays overall percent decrease in EMG values obtained during the first and last PMR training session for each subject. Prior to relaxation training, Subjects 1, 2, and 3 only had a 10, 6, and 7% decrease, respectively, in EMG values when instructed to "try to relax." Percent decreases in EMG values during the last session were 97, 56, and 63 for Subjects 1, 2, and 3, respectively. The last session represented the highest
percent decrease for all subjects. EMG readings indicate attainment of the PMR skill with all subjects.

Frequency of Attacks

The treatment effects on frequency of attacks are summarized in Figure 2. Subjects 1 and 3 presented a 33.3 and 96 % decrease, respectively. Subjects 2's number of attacks increased after treatment by 55 %.

Figure 1. Percent Decreases in EMG Values Assessing Ability to Relax.

Peak Expiratory Flow Values

Figure 3 summarizes the effects of PMR training on PEFR values. Both Subjects 1 and 3 exhibited an increase
from pre- to post-treatment. Subject 1 had a 5 % increase while Subject 3 had a 9.8 % increase in PEFR values. Pre- and post-treatment comparisons are not available for Subject 2 because of data lost in the mail and a severe illness prohibiting the use of the Flow Meter.

**Severity**

Table 1 summarizes the changes in severity of attacks for all subjects. All subjects exhibited a decrease in the severity of their attacks post-treatment. Subject 1 had a decrease of 4.76 % Subject 2's severity decreased by 11.3 % while Subject 3 displayed a 22.72 % decrease in severity of attacks.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Average Pre</th>
<th>Severity Post</th>
<th>Percent Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>1.05</td>
<td>1.0</td>
<td>4.76</td>
</tr>
<tr>
<td>Subject 2</td>
<td>1.33</td>
<td>1.18</td>
<td>11.3</td>
</tr>
<tr>
<td>Subject 3</td>
<td>1.29</td>
<td>1.0</td>
<td>22.72</td>
</tr>
</tbody>
</table>
Figure 2. Average Frequency of Attacks Pre- and Post- Treatment.

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Figure 3. Average Pre- and Post- Treatment PEFR Values.
Correlational Data

Table 2 summarizes the Pearson's correlation coefficients between a) number of attacks and inhaler use and b) PEFR values and number of attacks. A high positive correlation was predicted between number of attacks and inhaler use and a strong negative correlation between PEFR values and frequency of attacks. A strong positive correlation between number of attacks and inhaler use was seen in all subjects pre-treatment. Subject 1 was the only subject who demonstrated a decrease in the correlation between inhaler use and frequency of attacks post treatment. Subject 2's illness post-treatment undoubtedly contributed to the increased number of attacks and inhaler use to yield a .954 correlation. A perfect positive correlation was observed with Subject 3, who had only 1 attack post treatment.

<table>
<thead>
<tr>
<th># Attacks/Inhaler use</th>
<th>PEFR Values/# Attacks</th>
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<tbody>
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<td>Post</td>
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<td>Subject 1</td>
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</tr>
<tr>
<td>Subject 2</td>
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Subject 2 was the only subject to demonstrate a clear relationship between PEFR values and frequency of attacks. Low correlations were observed with the other two subjects. Subject 1 had a negligible negative correlation of -.219, while Subject 3 revealed a slight positive correlation of .270 between the two variables.
DISCUSSION

This study examined the effects of parental prompting of PMR application on the frequency of asthma attacks, PEFR values, severity and the relationship of inhaler use and the number of attacks. Two of the 3 subjects exhibited positive changes in 3 of the 4 dependent measures. Although some of the treatment gains were minimal, the long term implications for using PMR as an adjunctive treatment do look promising for moderately asthmatic children. It can be postulated that with the subject's repeated use of the skill, continued improvements on the fore-mentioned dependent variables might occur in the future.

In addition to the large percent decrease in EMG values, collaborating evidence suggests the subjects were practicing between sessions as instructed. Questions regarding length of practice sessions, sensations and difficulties experienced were generated by the subjects. Occasionally, the details were shared about their chosen reinforcing activity for practicing with the investigator of this study.

The hypothesis postulated that parental prompting for PMR application may reduce the frequency of attacks. The decreases seen post-treatment with Subjects 1 and 3,
suggests that parental prompting of PMR was instrumental in decreasing the frequency of asthma attacks. Subject 3 had one week pre-treatment with 40 attacks. Deletion of this week still yields a 90.3% decrease.

Illness resulted in both Subjects 1 and 3 experiencing their highest number of attacks per week during the post-treatment phase. The illness affected each quite differently. Subject 1's post-treatment illness, being rather mild, still resulted in a 33.3% overall decrease in his frequency of attacks. A 62.9% decrease is obtained if the week during the illness is eliminated in the calculations. Subject 2's increase in frequency was most likely precipitated by a severe respiratory infection. This illness was still severe enough one week after its onset to warrant steroid treatment. This sudden, unexpected illness makes it difficult to assess adequately a decrease in frequency of attacks for this subject.

PEFR values also slightly improved following treatment for Subjects 1 and 3. However, this increase was probably not enough for the subjects to notice a improvements in their pulmonary functioning. No pre- or post-treatment comparisons on PEFR values can be made for Subject 2 because of her severe respiratory illness, which contraindicated the use of the flow meter, coupled with data which were lost in the mail. However, given
this subject's 55% increase in attacks it is not very likely that any improvements would have been observed on this dependent measure.

Close examination of Subject 3's PEFR data revealed unexpected findings. This subject had the lowest PEFR values compared to the other subjects. Despite poor pulmonary functioning, this subject also had the lowest number of attacks. A plausible explanation may be his pharmacological management of his asthma. The many medications appear to be effective in maintaining a low number of attacks while not improving his PEFR values.

Encouraging results were also seen in the decreased severity of attacks. Subjects 1 and 3 both had the lowest post-treatment value possible, 1.0. A decrease in severity of attacks was also found with Subject 2 despite no significant changes in the other dependent variables. While P.A.R.T. was not effective in decreasing the frequency of her attacks, the average severity of her asthma attacks decreased by 11.3%. The decreases obtained may be a small portrayal of the decrease in severity for these subjects because of the rating system. The rating system devised for this assessment was not sensitive to large increases or decreases. Thus a floor effect occurred here because the pre-treatment values were already low.

Correlations between number of attacks and inhaler
use were conducted as this seemed like a logical indirect measure of treatment outcome. Inhalers are frequently prescribed for use at the onset of an attack. However, correlations conducted post-treatment for all 3 subjects did not reveal any significant decreases in inhaler use. Subject 2's post-treatment inhaler use increased quite unexpectedly given the 55% increase in asthma attacks. Her weekly number of attacks and inhaler use may have displayed a continued decrease given a post-treatment recording interval free of illness. A perfect correlation between number of attacks and inhaler use was found with Subject 3. His one attack post-treatment required the use of his inhaler, hence accounting for this high correlation. It is possible that as the PMR skill becomes more refined, decreases in inhaler use will become more pronounced.

Correlational analyses were also conducted between PEFR values and frequency of attacks. Subject 2 was the only subject displaying the expected significantly negative correlation between these two variables. The implication of the other correlation coefficients is unclear. It is unlikely that improper use of the flow meter created measurement error. Not only were all subjects instructed on the proper use of this instrument, but all have long histories on inhaler use. The technique necessary for proper inhaler use generalizes very
easily to correct PEFR assessment. More likely is the possibility that effort was poor because the reinforcer intended to maximize each subject's effort was too delayed to function adequately as a reinforcer for these young children.

In addition to the gains seen on the measured dependent variables, increased self confidence in subjects' ability to cope with attacks was also reported. Frequently, these children would find themselves in situations where their inhaler was unavailable. This created considerable anxiety. Progressive muscle relaxation provided these subjects with a coping skill which was always available. This coping skill was especially valuable as an adjunctive treatment for Subject 2. During the course of this study, this family faced severe cut-backs in health insurance coverage. Given this family's already strained financial situation, P.A.R.T. was a very welcome skill.

Future research in this area could address the use of this skill with adults classified as moderately asthmatic. Adults may be more motivated to learn the skill and its application than children. Adults are also more likely to be able to correctly identify the early stages of an attack hence implement PMR early enough to prevent an attack.

Replication of this study with a larger group of
subjects is also needed. It is difficult to make definitive statements regarding treatment efficacy with a small number of independent replications.

Additionally, relaxation is likely to be more effective in subjects whose asthma is primarily respondently controlled than those whose asthma is primarily operantly controlled. Delineation of operant and respondent factors and classifying each subject into one of the two categories may yield some interesting findings. Lehrer, Hochron, McCann, Swartzman, & Reba (1986) found that the site of airway obstruction appeared to be a critical factor in determining the effectiveness in relaxation therapy for asthmatics. Their correlational analysis suggested relaxation was helpful only in the subjects who had large-airway obstruction. This may also be a valuable area to explore in future research.

In conclusion, this study does suggest that positive results can be obtained when using PMR as a coping response to an asthma attack. With continued practice and application of this skill, it is likely over the long term that PMR may produce further significant decreases in frequency and severity, and improvements in pulmonary functioning.
Appendix A

Phone Screening Information
Phone Screening Information

Phone screening information
Child's name:
Parents name:
Phone #:
Address:

Is your child under stabilized medical management for his/her asthmatic symptoms?

Does your child have any other major illness besides asthma?

Does your child experience infections which precipitate asthmatic attacks?

Will you and your child be able to commit to 7 relaxation sessions (approximately 1 hour for the first two session and 1/2 hour or less for subsequent sessions), and 1 session following PMR training.

Approximately how frequently does your child have asthmatic attacks per week.

What is your child's age weight height

Sex ?

Criterion for study
** Experiencing one or more of the following
Symptoms during an asthma attack: trouble breathing, shortness of breath, wheezing, coughing, chest tightness, rapid or shallow breathing, mucus congestion, panting, or choking. (Attack/Episode will be defined as a period of time characterized by trouble breathing, shortness of breath excessive coughing and/or wheezing.)

** Exacerbation of cough and wheezing 3 to 8 times per week

** Cough and low grade degree of wheezing between acute episodes (severe symptoms of airway obstruction).

** Currently under stabilized medical management and supervision. (Have found a fairly effective medication and dosage; not experimenting with new meds or dosages.)
** Compliant with medications and instructions from physician.

** Between the age of 7 and 12.

** Willingness and ability to commit to time requirements.

** Perineal or daily symptoms of asthma.

EXCLUDED FROM STUDY IF:

**Infection based asthma

**Other major illness

**Unable to commit to time requirements
Appendix B

Interview Questions
Interview Questions

Background Information
At what age did your child begin to exhibit asthmatic symptoms?

What symptoms does your child exhibit currently? How often?

Does your child have any other major illness?

Is your child currently under medical supervision? How often do you have contact with your child's physician?

What medicines are currently being used?

How effective do you feel this medicine is?

If your child uses an inhaler, how many times per day does he use it?

What is your child allergic to?

Does your child receive immunizations, or shots, for these?

In the past year, approximately how many days has your child missed school due to asthma?

How well does your child exercise? How often

When do your child's asthma attacks usually occur?

What typically occurs when your child experiences difficulty in his breathing?

How frequently does your child experience asthma related problems?

How long do your child's attacks typically last?

On a scale of 1 to 10 (10 being most severe) how would you rate the severity of your child's attacks?

What typically occurs just prior to an attack?

Are there any events which may commonly be associated with the onset of attacks?

When does your child not have any attacks?
What events appear to be stressful for your child?

How do you and your spouse normally react towards your child during an attack?

How do you and your spouse normally react towards your child after an attack?
Appendix C

Informed Consent for Participation
INFORMED CONSENT FOR PARTICIPATION IN AN INVESTIGATION

Investigators: Kellye Hutton, and M. Michele Burnette, Ph.D.

I understand that I am being invited to participate in a research study entitled "Relaxation as an adjunct treatment in moderate asthmatics". This study will evaluate the effectiveness of relaxation techniques in reducing the frequency and duration of asthmatic attacks in children afflicted with mild to moderate asthma.

Participation in this study involves daily recording of frequency, duration, location of asthma attacks and peak flow values on index cards. Both parents and children will record the fore-mentioned variables for the duration of the study.

I understand that my child will be asked to participate in seven sessions of progressive muscle relaxation training (PMR). Pre and post electromyograph measures (muscle tension) will be taken during the relaxation training. Electrodes will be attached by tape or velcro. No pain is involved in this procedure. I recognize the fact that this is a skill to be learned. Progressive muscle relaxation, just like any other skill, requires practice before becoming good at it. I understand my child will be asked to sign a contract agreeing to practice on a daily basis.

As a parent involved in this study, I recognize the fact I also will be expected to be an active participant. Following the completion of my child's PMR training, I will be asked to come in for one brief session. Relevant applications of PMR skills will be discussed along with ways to assist my child's ability to apply this skill. I understand that my participation in this study is voluntary. There is no cost to me for participation. A reduction in the frequency of asthmatic attacks is the primary expected benefit for the child participant of this study.

All information obtained during the course of this study will be held in the strictest of confidence. A code number will be assigned to me and used to identify all information used for analysis in this research. Name and number codings will be destroyed after analysis of the data. I may withdraw from the study at any time.

I understand that any questions or complaints I have now or in the future can be answered by contacting Kellye Hutton at 668-4881 or Michele Burnette Ph.D. at 387-4472.

My signature below indicates that I have read and understood the above information and have decided to participate in the study.

Signature of Parent of Guardian________________________Date___
____Time____

I as a child participant have had the above form explained to me in such a way that I understand the study and my involvement_________________

Signature of investigator________________________

Code #________
Children's Informed Consent

I understand that I'm being asked to join a study. This study wants to learn more about asthma and how to help children who have asthma. My joining will help many others who also have asthma.

I will be taught the skill of progressive muscle relaxation. Relaxation can help people when they are upset or scared. Many people get upset and scared when they have an asthma attack. Relaxation skills are expected to help you with your asthma. Relaxation may even be helpful when you are not scared. Relaxation may help you learn to control your attacks. We will be looking to see if the number of asthma attacks you have decreases.

Progressive muscle relaxation is a skill much like riding your bike or swimming. It takes practice before I will be able to do it well. Practicing this skill every day is very important. Practice will not take much time.

Electromyograph is a machine which measure muscle tension. My muscle tension will be recorded during my relaxation training sessions. Electrodes are used to measure your muscle tension. An electrode will be taped to my skin. This will not hurt at all. This will let me know if I can become relaxed during the training sessions. (When you are relaxed, your muscle tension will decrease.)

During the study I will be given a peak flow meter to use. This tells others how well my lungs are working. Two times a day I will be expected to blow into this and write the numbers down.

I will be asked to fill out a piece of paper every day. This will help determine if this skill has been helpful. This will not take more than 10 minutes each day.

Joining the study is free. Treatment is free. No physical or emotional pain will be experienced. Prizes will be given out during the study. A special prize will be given for those who complete the study.

I can quit the study at any time.

My signature below means that I have read this page. Kellye Hutton has also read this out loud to me. I am interested in joining this study.

Signature of Child ________________ Date________
Signature of Investigator ____________ Date________
Appendix D

Behavioral Contract
Behavioral Contract

I ___________________________ agree to practice relaxation daily.

If this task is completed, the following will occur:_____ 

If this task is not completed, the following will occur:____

Signed:_____________________ Date:______________

__________________________
Investigator: ____________

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Appendix E

Daily Recording Forms
DAILY RECORDING FORMS

Code_______
Date_______
For each asthma attack please record the following:
  Symptoms experienced: ____________________________________________
  ____________________________________________
  ____________________________________________
  ____________________________________________
  Location of attacks: ____________________________________________

Medications taken: 
  What:__________________________
  When:__________________________
  Dosage:________________________

Peak flow values: 
  am.__________pm.___________

Relaxation practice:
  before_______after_______

Number of times inhaler used: ________________________________
  -----------------------------Relaxation used

Yes/no (circle one)  Initials_______
Promts used? Yes/no (circle one)  What said?
 Drill
Appendix F

Muscle Groups
Muscle groups

First two sessions:
1. Dominant hand and forearm
2. Dominant biceps
3. Nondominant hand and forearm
4. Nondominant biceps
5. Forehead
6. Upper cheeks and nose
7. Lower cheek and jaw
9. Chest, shoulder and upper back
10. Stomach area
11. Dominant thigh
12. Dominant calf
13. Dominant foot
14. Nondominant thigh
15. Nondominant calf

Third session:
1. Muscles of Dominant hand, lower arm and biceps
2. Muscles nondominant hand, lower arm and biceps
3. Three facial muscles
4. Neck and throat
5. Chest, shoulders, back and abdomen
6. Muscles of dominant thigh, calf and foot
7. Muscles of nondominant thigh, calf and foot

Fourth session:
1. Muscles of both arms, hands and biceps
2. Face and neck
3. Chest, shoulders, back and stomach
4. Muscles of both legs.

Fifth session:
Four muscle groups with recall.

Sixth session:
Four muscle groups with counting.

Seventh session:
Counting.
Appendix G

Relaxation Handout
Relaxation Handout

The relaxation skill which is being used to teach your child is a modified version of the Jacobsonian model. Asthma is caused by the constriction of the air pathways. Relaxation intends to counteract this constriction making it easier for your child to breathe. Additional benefits may include a reduction in medical dependence in managing asthma. The ultimate goal, once the relaxation skills are mastered, is for your child to begin the relaxation techniques upon contact with events and stressors which may lead to an attack.

Like many other activities we engage in daily, relaxation must be practiced daily in order to improve and become adept with the skill. Think of a child learning to ride his bike. At first he may fall or wobble unsteadily while riding. With time and repeated practice a child can ride the bike very naturally. Relaxation is very similar, at first it may feel awkward but with time and practice it begins to become very natural. The old saying, "Practice makes perfect" is very appropriate here.

Several conditions must be thought out before the practice begins, to ensure successful home practice. One important consideration is where your child can practice such that he/she is unlikely to be disturbed by television, phone, doorbell, outdoor distractions and other people. Secondly, find a comfortable chair or bed which fully support the body, yet keeps your child in an upright position. Finally it must be determined when the practicing is to occur. Ideally this practice time should not be rushed. For example, a bad time to practice would be right before school or some activity. Favorable practice times may include after school, just after dinner, or shortly before bedtime. If just before bedtime is chosen, it is important that your child is not so tired that he/she will fall asleep during practice.

Throughout this training the relaxation practice must not be thought of as a chore!!!!!! The practicing is essential in learning the skill and does not have to be bothersome. As an incentive to practice, engaging in some highly desired activity contingent upon practice will be used. For example, after your child practices he can: watch t.v., be read a story, go outside and play, play a special game, make a phone call or any other activities he/she is particularly fond of. Before ending the first relaxation session, you and your child will be asked to sign a contract stating that you agree to practice at specified times daily. This contract will also include a list of activities your child can choose from after completing his/her practice in an addition to the consequences of failure to practice. Time will also be spent covering the details for the location of the practice.

Your relaxation program is an individualized treatment. It is very important that the relaxation skill not be used other than practice until all 7 sessions have been completed. Professional assistance is necessary in proper learning of the skill. If skill is used prior to end of training this may result in unnecessary failure.
Appendix H

Parent Assisted Relaxation Training
Parent Assisted Relaxation Training (P.A.R.T.)

The primary goal of this program is to increase your child's ability to cope with asthma attacks. As a parent, you will be working with your child to help him/her learn how to use the relaxation skills in relevant situations. Because asthma is caused primarily by physiological and biological reactions, P.A.R.T. will not be able to eliminate attacks but hopefully decrease either frequency or duration of the attacks. As a parent, we hope that because of this program you will feel comfortable in knowing your child will be able to manage asthma attacks independently of you if necessary.

GOALS
1. Individualized cue assigned for each child.
2. Parents will pick two times during the week which they will surprise their child with an asthma drill.
3. Parents will prompt their child to begin relaxation if an asthma attack appears eminent.

DRILL
1. Say cue word.
2. Watch for signs that your child is going through PMR.
3. If your child completes PMR spend 5-10 minutes with him/her giving your undivided attention in a special activity or game. If your child did not complete PMR and return to step one.

GUIDELINES FOR CHOOSING DRILL TIME
1. Relatively few people present initially. As your child becomes more adept with the skill, you may want to test his/her ability to relax in the presence of other people.
2. Your child may be more comfortable in participating in these drills if he/she is in a comfortable, familiar setting.

PROMPT
1. Identify situations which your child is likely to experience asthma attacks along with early symptoms of an attack.
2. Say cue word when conditions outlined in step 1 are present.
3. Watch for signs that your child is going through PMR.
Appendix I

Predicted Peak Expiratory Flow
Predicted Peak Expiratory Flow

Normal Children

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<tr>
<th>Height (Inches)</th>
<th>Males &amp; Females</th>
<th>Height (Inches)</th>
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</table>

TO: Kellye Hutton
FROM: Ellen Page-Robin, Chair
RE: Research Protocol
DATE: April 20, 1989

This letter will serve as confirmation that your research protocol, "Relaxation as an Adjunct Treatment in Moderate Asthmatics," has been approved with modifications and signed off by the HSIRB.

If you have any further questions, please contact me at 387-2647.
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