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Pediatric Pain Letter

Abstracts and Commentaries on Pain in Infants, Children, and Adolescents

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Editorial

This issue of the *Pediatric Pain Letter* focusses on non-pharmacological methods for reducing, but not eliminating, two common and troublesome types of pain. Headache can be a disabling problem in adolescents, and can significantly interfere with their ability to go to school or participate in extracurricular activities. Pharmacological approaches can be unsatisfactory, so this commentary on relaxation and biofeedback techniques is welcome.

Newborn infants routinely suffer heelsticks for blood sampling. Sick newborns in intensive care units can have many heelsticks every day for many days, as well as other procedures. We do not have a practical and reliable pharmacologic analgesic for this situation, but swaddling and rocking are both instinctive and universally available. Dr. Johnston comments on some of the recent literature in this area.

In the Announcements section you will find a notice for the 3rd Biennial International Forum on Pediatric Pain, which we are looking forward to hosting in Nova Scotia in September, 2000. The proceedings of the 2nd Forum, *Chronic and Recurrent Pain in Children and Adolescents*, are now available from IASP Press (see pg. 35 for details).

Finally, we would like to remind you that we welcome your comments and suggestions as we near the end of three years of publication.

Abstracts

Psychological treatment of recurrent headaches in children and adolescents

Bussone, G., Grazzi, L., D'Amico, D. & Andrasik, F. (1998). Biofeedback-assisted relaxation training for young adolescents with tension-type headache: a controlled study. *Cephalalgia*, 18, 463-467.

Objective. To examine the effectiveness of biofeedback treatment in young adolescents with tension headache.
Design. Randomized controlled trial.
Setting. Headache clinic.
Participants. Thirty adolescents aged 11-15 years who fulfilled the IHS criteria for tension-type headache and had headaches at least once a week. Twenty participants were treated with biofeedback-assisted relaxation and 10 received a relaxation placebo treatment. Five subjects dropped out from the treatment control group.
Intervention. Subjects were randomly assigned to one of 2 treatments. In the biofeedback-assisted relaxation group progressive relaxation procedures were used for the first 4 sessions and EMG biofeedback during the last six. The training was limited to the clinic and subjects were instructed not to practice at home. In the attention-control condition, subjects were instructed to relax and sit quietly and no feedback about changes in EMG activity was given during the 10 sessions.
Main Outcome Measures. A headache diary was kept before treatment 1, 3, 6, and 12 months after treatment. Subjects recorded their headaches every hour on a 5-point scale. A composite measure, the Pain Total Index, was calculated from the number of hours with headache for each of the pain levels. In addition, the subjects rated their anxiety symptoms on a standardized measure (State-Trait Anxiety Inventory for Children).
Results. Few differences between the two groups emerged after treatment but at the 6 and 12 month evaluations the pain levels were significantly lower in the biofeedback-assisted relaxation group. Eighty-six percent of subjects had improved as compared to 60% in the attention-control group. There was a slight decrease in anxiety symptom levels in both treatment groups. Mean EMG resting levels did not change during the study or differ between the two groups.
Conclusions. Although just sitting quietly during 20 minutes for 10 sessions did improve headache activity in the adolescents, those who received feedback training in the clinic showed a further improvement some time after treatment. Therefore it is suggested that EMG-biofeedback combined with relaxation training might be an optimal treatment for young adolescents with tension-type headaches.

Engel, J.M., Rapoff, M.A. & Pressman, A.R. (1992). Long-term follow-up of relaxation training for pediatric headache disorders. *Headache*, 32, 152-156.

Objective. To examine long-term effects after psychological treatment of recurrent headaches in children and adolescents
Design. Follow-up of randomized controlled trial.
Setting. Schools.
Participants. Out of 20 subjects in the original sample 17 (85%) (11 girls; mean age=17 years, range 11-21 years) participated in the follow-up. In the original study about one third had migraine only, one third had migraine with tension-type headache, and one third had tension-type headache only. Inclusion criteria were headaches at least three times per month for more than six months.
Intervention. The subjects had previously received either autogenic training, progressive relaxation or both combined. Four subjects had participated in a waiting-list control group.
Main Outcome Measures. For a 4-week period subjects kept a headache diary in which they also recorded rest time due to headaches and analgesic intake. In a structured interview they were questioned about additional treatment, the use of relaxation techniques, and continued headache activity.
Results. Subjects treated with relaxation had less severe headaches and more headache-free days than those in the control group. Those who were treated with some form of relaxation showed better headache improvement than subjects in the other groups. No differences between groups were noted for medication and rest time (reported to be minimal at follow-up). All subjects still reported some headache activity and about one third of the sample had received additional treatment. Almost all subjects treated with relaxation would recommend it to others with a headache problem.
Conclusions. Good maintenance of improvement 3-4 years after relaxation treatment was found, particularly for headache severity and frequency. These benefits were not limited to reduction of headache activity but also improved stress management and sleep. The results were obtained in

spite of no further treatment (e.g. booster sessions during follow-up).

Hermann C., Blanchard, E.B. & Flor, H. (1997). Biofeedback treatment for pediatric migraine: prediction of treatment outcome. *Journal of Consulting and Clinical Psychology*, 55, 611-616.

Objective. To examine predictors of outcome for children and adolescents with migraine treated with thermal biofeedback.
Design. Single group study.
Setting. Headache clinic.
Participants. Thirty-two children (19 boys; 8-16 years old) diagnosed with migraine alone (90%) or combined with tension-type headache (10%) (IHS criteria). Inclusion criteria were at least two attacks per month for 6 months or more.
Intervention. Over an 8-week period 4 therapist-assisted sessions in the clinic and four self-administered manual-based sessions at home.
Main Outcome Measures. The subjects kept a headache diary for 4-week periods before and after treatment, in addition their medication and school absences were recorded. The children's psychosocial functioning was assessed with the Child Behavior Checklist (CBCL) and self-report of somatic complaints, depressive and anxiety symptoms, and family functioning.
Results. Between baseline and post-treatment the subjects showed a 60% improvement in headache index, a decrease in medication, and a decrease in school absences. About two thirds of subjects had achieved at least a 50% improvement. Externalizing behaviour, somatic complaints, and age (younger children were more improved) were found to predict treatment success and together these variables explained 35% of the outcome variance. However, treatment outcome was not predicted by gender, family functioning, baseline headache activity, headache history, diagnosis, or frequency of home practices.
Conclusion. Results suggest that emotional distress or school stress play an important role among adolescents with migraine. However, somewhat surprisingly, higher levels of externalizing behaviours (aggressiveness or noncompliance) predicted a better outcome. It should be emphasized that predictions were estimated for a thermal biofeedback treatment based on minimal-therapist contact for children with migraine.

Hermann C., Kim, M. & Blanchard, E.B (1995). Behavioral and prophylactic pharmacological intervention studies of pediatric migraine: an exploratory meta-analysis. *Pain*, 60, 239-256.

Objective. To examine the effects of psychological and drug treatments for migraine in children and adolescents.
Design. Meta-analysis of comparative group and multiple baseline studies.
Setting. Clinic and school.
Participants. Seventeen behavioural and 24 drug studies were included. Thirty-four percent of the behavioural studies and 14.7% of the drug studies initially selected during a literature search were excluded because of methodological limitations or lack of information.
Intervention. Behavioural treatments were classified into different types (e.g. biofeedback, relaxation and autogenic training, cognitive therapy, hypnosis, psychological placebo, and waiting-list control) and drug treatments were classified on the basis of their mechanism of action (e.g. beta- and calcium blocker, serotonergic, dopaminergic, and placebo).
Main Outcome Measures. Effect sizes (ES) based on changes between baseline and post-treatment in headache activity were calculated for the various treatment groups (within group) but also compared to control conditions (between-group). More than one ES could be estimated for a single study. Quality of the study was also graded on a 0-2 scale.
Results. A control condition was included in only 9 behavioural studies and 11 drug studies of prophylactic treatment. Thermal biofeedback alone or combined with progressive relaxation was found to be the most effective treatment. There was a large heterogeneity in the estimates of ES in the drug studies. Overall, all active treatments were shown to be superior to placebo and waiting-list control conditions. Only two studies evaluated the effects of the beta-blocker propranolol with mixed results which is in contrast to the use and prescription of these drugs in clinical practice.
Conclusion. The authors underline the importance of evaluating credible placebo treatments and to identify the most active components in progressive relaxation and biofeedback treatments. Direct comparisons between various psychological and drug treatments should also be performed. Other methodological short-comings in treatment research are discussed and suggestions made to improve quality in controlled outcome studies.

Larsson, B., & Melin, L. (1989). Follow-up on behavioral treatment of recurrent headache in adolescents. *Headache*, 29, 250-253.

Objective. To examine long-term effects after psychological treatments of recurrent headaches in adolescents.
Design. Randomized controlled trial.
Setting. School.
Participants. Of 108 adolescents previously treated, 75 (69%) (67 girls; 16-18 years old) participated in a 3-4 year follow-up evaluation. Eighty percent had tension headache and 20% had migraine headaches (at the first evaluation). Sixty-eight percent of those previously in relaxation training group, 83% of those previously in the attention-control group, and 78% of those previously in the self-monitoring group participated in the follow-up.
Intervention. Subjects received some form of relaxation training (therapist-assisted or self-help, home based approach), attention-control (information or problem-discussion) for five weeks or they self-monitored their headaches. Eight subjects (11% of the follow-up sample) received additional treatment during the follow-up period.
Main Outcome Measure. Subjects kept a headache diary for a 4-week period in which all headaches were rated on a 0-5 scale and recorded four times daily (breakfast, lunch, afternoon, and bedtime). For comparisons, previous baseline, post-treatment, and 5-6 month follow-up recordings were used.
Results. Overall, improvements after relaxation treatment were well maintained and headache activity decreased by about one third among those who only self-recorded their headaches. There was a striking improvement for subjects in the attention-control condition (65% reduction, in headache activity, from baseline). A higher baseline headache activity was found to predict a better outcome.
Conclusions. Once an improvement of headache activity has been achieved after relaxation training for adolescents with recurrent headaches, the effects are stable over a longer time period. Those who self-monitor their headaches improve moderately over the same time period. However, subjects treated with attention-control procedures showed a substantial improvement suggesting that non-specific treatments might be beneficial from a long-term perspective.

McGrath, P.J., Humphreys, P., Goodman, J.T., Keene, D., Firestone, P., Jacob, P. & Cunningham, S.J. (1988). Relaxation prophylaxis for childhood migraine: a randomized placebo-controlled trial. *Developmental Medicine and Child Neurology*, 30, 626-631.

Objective. To examine the effectiveness of three psychological treatments for children and adolescents with migraine.
Design. Randomized controlled trial.
Setting. Migraine clinic.
Participants. Ninety-nine subjects (69 girls; 9-17 years old) suffering from migraine headache at least once per week for three months or more. In addition, they had to fulfill 2 of the following 4 criteria: family history of migraine, aura, throbbing pain, nausea or vomiting. Children who had started medication for their headaches were excluded.
Intervention. Children were treated with either relaxation training, placebo or 'Own best effort' treatment. Relaxation training was provided during 6, 1-hour individual sessions consisting of sequential tensing and relaxation of large muscle groups, sequential relaxation without tensing, and differential, self-cueing, and 'mini' relaxation. Children were instructed to practice daily. The placebo group was taught to recognize their emotions and to discuss their feelings with a friend or parent. Another aim of this approach was to control for attention and number of sessions used in the relaxation treatment condition. In the 'Own best effort' treatment subjects had one session with a therapist to discuss the importance of various triggers and self-monitoring of their headaches.
Main Outcome Measures. Subjects kept headache diaries for 4-week periods before and after treatment and at 3-month and one year follow-ups. Subjects rated headache intensity on a 0-5 scale. Credibility ratings were also recorded after the first and last session.
Results. There was a substantial attrition rate (37 did not complete treatment), however, credibility ratings were equal in the three treatment groups. Although there was a decrease of headache activity over time no differences between groups or interaction effects emerged.
Conclusions. Results indicate that including a credible treatment method such as techniques for self-control of headaches might be important for improving migraine in children. Relaxation training was not more effective than attention-control procedures and no more effective than a single session of advice and information. Although frequent migraine (at least once a week) in adolescents was studied, this type of headache is variable and the positive effects of reassurance and assistance provided by professionals at a highly specialized clinic are substantial. The authors emphasize the importance of controlling for the effects of attention and other unspecific factors.

McGrath, P.J., Humphreys, P., Keene, D., Goodman, J.T., Lascalles, M.A., Cunningham, S.J. & Firestone, P. (1992). The efficacy and efficiency of a self-administered treatment for adolescent migraine. *Pain*, 49, 321-324.

Objective. To examine the efficacy and cost-effectiveness of psychological treatments for adolescent migraine.
Design. Randomized controlled trial.
Setting. Migraine clinic.
Participants. Eighty-seven adolescents (63 girls; 11-18 years old) with migraine were included. Inclusion criteria were at least 2 migraine attacks a month for more than 3 months and at least 2 of: 1) family history of migraine, 2) aura, 3) throbbing pain, 4) nausea or vomiting.
Intervention. Subjects were treated with either a clinical-based or self-help approach in which they received instructions about coping and relaxation strategies. The subjects in the first treatment group met individually with a therapist and those in the self-help approach received instructions via a manual and audiotape. They had one initial appointment and were then contacted weekly by telephone. In the control group, subjects were given a list of possible triggers of migraine and asked to become aware of and try to avoid them. This latter group served to control for the amount of therapist contact provided to adolescents in the self-help group.
Main Outcome Measures. Subjects recorded headache intensity ratings (0-5 scale) in headache diaries for 4-week periods before and one month, 3 months, and one year after treatment. Total headache activity during the various phases was used as the main outcome measure. Depressive symptoms were assessed by means of the Poznanski depression scale.
Results. The headache activity in the two treatment groups was similar at various follow-up assessments. At the one-year follow-up the improvement was somewhat larger for subjects in the self-help group and a higher proportion of subjects (67%) had attained a 50% or more improvement than among those who had received therapist-assisted treatment (44%). The control group did not change between baseline and one-month follow-up evaluations. The self-help treatment was about 3 times more cost-effective (amount of therapist contact) than the clinic-based treatment.
Conclusions. The authors conclude that there now exists cost-effective psychological treatments for adolescents with chronic severe migraine headaches. A professional handbook has been developed for nurses, physicians, and others as a guide to help them administer treatment.

Osterhaus, S.O.L., Lange, A., Linssen, W.H.J.P. & Passchier, J. (1997). A behavioral treatment of young migrainous and nonmigrainous headache patients: prediction of treatment success. *International Journal of Behavioral Medicine*, 4(4), 378-396.

Objective. To examine effectiveness of behavioural treatment and predictors of outcome.
Design. Randomized controlled trial.
Setting. Headache clinic.
Participants. Thirty-nine young headache patients (20 females; 12-22 years old) suffering from migraine or tension-type headache. Forty-six percent had tension-type headaches and about half of the migraine sufferers also had tension-type headaches. Inclusion criteria were 2 or more headaches a month for at least a year. The IHS criteria were used for a headache diagnosis.
Intervention. Twenty-four adolescents were treated during eight sessions first in groups followed by individual treatment. Treatment included psycho-education about pain and headaches, various methods of relaxation, rational emotive therapy, and finger temperature biofeedback. Fifteen subjects were assigned to a waiting-list condition.
Main Outcome Measures. A daily headache diary was kept during a 4-week period in which the subjects rated headache intensity on a 5-point scale. The product of duration and intensity of every headache episode was used to calculate a headache index. In addition, the subjects' somatic complaints, encouragement of illness by the mother, cohesion in the family, and parent-child interaction were assessed.
Results. Overall, the treated adolescents showed headache reduction of 46%, whereas subjects in the waiting-list group had a slight increase (5%). Half of the subjects in the treatment group achieved a 50% or more reduction in headaches whereas none in the waiting-list group improved to such a level. Adolescents with tension-type headache attained a 56% improvement but those with migraine alone or combined with tension-type only attained a 20-24% reduction. Besides total headache activity, headache frequency also improved. Younger children improved more than older ones and those with a longer history improved less. Maternal rewarding of children's illness behaviour was negatively correlated with headache improvement. Improvements were well maintained at a 1-year follow-up.
Conclusions. The authors replicated a previous study conducted in a school setting with adolescent migraineurs and found similar outcomes (Osterhaus et al., 1993). The adolescents with tension-type headaches showed a better response to treatment than those with migraine headaches.

The authors suggest that rewarding of illness behaviour and the child-mother interaction are important dimensions to include in the assessment of outcome. Of interest in this study is that illness encouragement from mothers was associated with less headache reduction in the adolescents.

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.

Objective. To examine the efficacy of psychological treatment as compared to a prophylactic drug regimen with a beta-blocker, metoprolol.
Design. Randomized controlled trial.
Setting. Migraine clinic.
Participants. Forty-three children (26 boys; 8-16 years old) with migraine were included. IHS criteria were used for diagnosis and subjects had migraine for at least 6 months and experienced 2 attacks during the previous month. For subjects who experienced migraine combined with tension-type headaches (approx. 66%) both headaches types were assessed.
Intervention. Two types of psychological treatment were compared to drug therapy with a beta-blocker, metoprolol. Psychological treatments were stress management techniques utilising either cephalic biofeedback or relaxation training. Training occurred during 10 individual sessions over a six week period.
Main Outcome Measures. Subjects kept a headache diary during a 4-week period before and after treatment, in addition to a 2-week period at the 8-month follow-up. Analgesic medication and mood were also assessed. Blood volume pulse amplitude was recorded in the two psychological treatment groups.
Results. Various aspects of headache activity decreased in all treatment groups. Significantly more subjects (80%) treated with relaxation attained a 50% or more improvement as compared to those treated with metoprolol (42%). The decrease in headache frequency and intensity was higher for migraine than for nonmigrainous headaches. Improvements were well maintained at the 8-month follow-up.
Conclusions. The results indicate that stress management training combined with relaxation training is effective in reducing headache activity in children suffering from migraine headaches (often combined with nonmigrainous headaches). Drug therapy with a beta-blocker, metoprolol, had smaller and insignificant effects.

Commentary

There is substantial evidence that various psychological methods are effective in the treatment of migraine and tension-type headaches in children and adolescents. This is especially important because prophylactic or abortive drug treatment is not very effective for migraine in these age groups.

Thermal biofeedback seems to be the most effective treatment for migraine in children and adolescents, and relaxation training or EMG biofeedback for adolescents with tension-type headaches. Psychological placebo treatments and self-monitoring of headaches have generally been ineffective.

Migraine is often combined with tension-type headaches. Until recently, no attempts have been made to differentiate outcome between the two types of headaches, and the findings have shown mixed results. In agreement with reported outcomes of relaxation treatment for adult headache sufferers (Blanchard & Andrasik, 1985) a worse treatment response has been found for migraine (all migraine and nonmigrainous headaches summarized together) than for tension-type headaches among school adolescents (Larsson & Melin, 1988). Patients need to be specifically asked if they have more than one type of headache, and if so, to monitor both types in outcome research. This aspect needs to be further studied in future research.

Further, it is unclear whether recurrent headaches in children and adolescents respond better to combined treatment strategies. Such packages have included cognitive coping procedures, educational information about headaches, relaxation or biofeedback procedures (Osterhaus et al., 1993). It might be that combined strategies are more effective in the treatment of migraine sufferers than single treatments that have proven to be effective for tension-type headaches in adolescents. However, our knowledge about the optimal combination of such procedures is very limited. In empirical studies positive outcomes have been shown after six sessions of psychological treatment.

In several studies, relaxation training alone or combined with cognitive procedures administered in a self-help, largely home-based format have shown positive outcomes for adolescents with migraine or tension-type headaches. Such cost-effective treatments might be valuable for motivated adolescents interested in investing time and effort to their headache problems. In our replication series, however, we found that therapist- assisted relaxation training was more effective than self-help procedures for

adolescents with tension-type headaches. Psychology students and supervised school nurses with quite limited formal training in the treatment were the therapists. Little is known about what therapist factors and format (i.e. individual or group treatment) works best for children and adolescents.

Few direct comparisons have been made between drug and psychological treatments for childhood headache sufferers. Psychological treatments for migraine were superior to a prophylactic drug regimen with a beta-blocker (Sartory et al., 1998; Olness, Mac Donald & Uden, 1987), and similar results have been obtained in a study of adolescent tension headache sufferers in a comparison with a muscle-relaxant drug (chlormezanone) (Larsson, Melin & Döberl, 1990). Other aspects of treatment such as acceptability, ease of administration and demands on the child or their parents should be evaluated. Adolescents or parents are often quite reluctant to use drug therapy. Psychological treatment has also shown to have other positive effects such as improved sleep and stress symptoms. However, concomitant psychological symptoms such as depressive and anxiety problems, commonly associated with recurrent headaches, have shown a small, unspecific decrease after treatment. Inconsistent evidence exists for reductions in medication usage or school absence.

Besides treatment and type of frequent headache (at least twice a month) predicting treatment outcome, inconsistent results have been reported for other factors such as age, severity and chronicity of headaches, family functioning, home practice of biofeedback procedures, and behavioural and emotional problems including other somatic complaints. In a recent study (Osterhaus et al., 1997) parental (mother) reward of illness behaviour was found to be a negative predictor of outcome for psychological treatment. This important area needs to be examined in future research on recurrent headaches in children.

In most outcome studies short-term results after psychological treatment show a further improvement of headaches in children and adolescents, and these improvements are well maintained 3-4 years after psychological treatment.

Although controlled studies conducted both in clinic and school settings show positive outcomes for migraine as well as tension-type headaches in children and adolescents, these studies have been conducted in research projects and not as part of ongoing evaluation of routine treatment. We therefore need to know much more about how such treatments also work in field settings as administered by clinicians and school health professionals. When school health service exists, school nurses with formal training seem to be the optimal group for delivering treatment to children and adolescents who commonly seek their help because of recurrent headaches (Larsson & Carlsson, 1996).

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Larsson, B. & Melin, L. (1988). The psychological treatment of recurrent headache in adolescents: short-term outcome and its prediction. *Headache*, 28, 187-195.

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

Olness, K., MacDonald, J.T. & Uden, D.L. (1987). Comparison of self-hypnosis and propranolol in the treatment of juvenile classic migraine. *Pediatrics*, 79, 593-597.

Osterhaus, S.O., Passchier, J., van der Helm-Hylkema, H., de Jong, K.T., Orlebeke, J.F., de Grauw, A.J. & Dekker, P.H. (1993). Effects of behavioral psychophysiological treatment on schoolchildren with migraine in a nonclinical setting: predictors and process variables. *Journal of Pediatric Psychology*, 18, 697-711.

"Rock-a-bye Baby" or the effect of rocking and swaddling on pain response in infants

Campos, R.G. (1994). Rocking and pacifiers: Two comforting interventions for heelstick pain. *Research in Nursing and Health*, 17, 321-331.

Objective. To explore the role that comforting interventions (rocking and pacifiers) have on easing infant stress following heelstick procedures.
Design. Randomized controlled trial.
Setting. Neonatal nursery.
Participants. 60 healthy newborns (mean age=51.5 hours; mean weight=3.56 kg) divided into 3 groups consisting of 10 males and 10 females. Inclusion criteria were full-term birth, Apgar score >7 and absence of any respiratory or other health problems.

Intervention. Infants were randomly assigned to one of three post-heelstick conditions; rocking (infants were held at experimenter's shoulder rocked at a rate of 30 cycles /minute), pacifier (infants were held on the experimenter's lap and administered a pacifier), or control (placed in a basinette and given no comforting intervention). Interventions were administered for 8 minutes and observations were continued for 8 minutes following the removal of the intervention. For the control group, observations also took place over the 16 minute intervention and post intervention time period.
Main Outcome Measures. Vocalization was determined by the number of seconds that audible sounds were detected from the infant during 15 second intervals throughout the intervention and post-intervention period. Cry cessation was calculated as the time spent crying from the beginning of the intervention period until complete termination of crying for 1 minute and persistence of cry was measures as 10 seconds or more of crying in 15-second intervals during the intervention period.
Results. Infants in the pacifier and rocking conditions had fewer persistent crying bouts during intervention than controls ($p<0.01$). Differences between conditions for latencies of cry to cessation were significant, with the pacifier intervention producing quicker cessation than rocking or control ($p<0.05$). Significant differences in heart rate were apparent between conditions, with higher heart rate levels observed for infants in the rocking condition ($p<0.01$). Latency to return to baseline was quicker for the rocking and pacifier groups than the control group, however, the difference did not reach significance. With respect to infant state, rocking produced more quiet alert states during intervention than pacifier or control ($p<0.01$) and pacifiers were more likely to produce active sleep than either rocking or control. There were no significant differences found between conditions for measures taken during the post intervention period. Termination of intervention yielded increased crying and heart rate in both intervention conditions.
Conclusions. The results provide further evidence for the power of non-pharmacological interventions in minimizing the stress experienced by infants during routine procedures. Although effective in reducing pain related stress, rocking was not as effective as pacifier. Seemingly contradictory findings, such as rocking reducing crying but not heart rate, imply further research is needed to assess the mechanisms that are involved in soothing interventions. In addition, the post intervention period should also receive attention in order to determine the range of responses associated with termination of comfort.

Corff, K.E., Seideman, R., Venkataraman, P.S., Lutes, L. & Yates, B. (1995). Facilitated tucking: A nonpharmacologic comfort measure for pain in preterm neonates. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 24(2), 143-147.

Objective. To determine the effectiveness of facilitated tucking in reducing neonates' physiologic and behavioural responses to a heelstick procedure.
Design. Within-subjects experimental study.
Setting. Neonatal intensive-care unit (NICU).
Participants. A convenience sample of 30 pre-term infants, 10 each in the age groups 25-28 weeks, 29-31 weeks, and 32-35 weeks (mean overall age=30 weeks). Birth weight ranged from 660-2500 g (mean weight=1327 g). Exclusion criteria were: chromosomal or genetic anomalies; central nervous system anomalies; Apgar scores of <5 at 5 minutes; congenital heart disease; dysmorphic syndrome; or infants receiving sedating medications.
Intervention. Infants served as their own controls. In the experimental condition, facilitated tucking (i.e. a gentle motoric containment of the infants' limbs, tucked into the infants' trunk, while in a supine position) was administered by a neonatal nurse during and after the heelstick.
Main Outcome Measures. Heart rate, oxygen saturation, and sleep state were recorded during a 12-minute baseline period prior to heelstick, during the heelstick procedure, and for 15-minutes after heelstick.
Results. There were no significant differences in observations between experimental and control trials during baseline, nor were significant differences in oxygen saturation between trials observed. Differences in means were calculated for all observations made between experimental and control trials. Across both experimental and control trials, heelstick yielded an increase in heart rate, however, with facilitated tucking, there was a quicker return to baseline heart rate following heelstick (control HR=154.9 bpm vs. experimental HR=149.1 bpm; $p<0.04$). During the 15 minute post-heelstick period, all observed sleep state variables were significantly lower for experimental trials than control trials (time to first quiet, $p<0.005$; total crying time, $p<0.001$; total sleep disruption time, $p<0.001$; total sleep state changes, $p<0.003$).
Conclusions. The findings have important implications for nursing practices in the NICU where comfort and pain management are essential elements in the support of immature infants. Facilitated tucking is an effective, non-pharmacological comfort intervention which can aid in minimizing potential pain and distress associated with minor procedures.

Fearon, I., Kisilevsky, B.S., Hains, S.M.J., Muir, D.W & Tranmer, J. (1997). Swaddling after heel lance: Age-specific effects on behavioral recovery in preterm infants. *Developmental and Behavioral Pediatrics*, 18, 222-232.

Objective. To investigate the occurrence of developmental changes in pain responses to heelstick procedures followed by swaddling or standard care.
Design. Within subjects experimental study.
Setting. Neonatal intensive care unit (NICU).
Participants. The younger group was composed of 7 infants (post-conceptual age (PCA) range 27-30 weeks,; mean PCA=29.6 weeks; mean chronological age (CA)=1 week, 6 days). The older group was composed of 8 infants (PCA range 31-36 weeks; mean PCA=33.7 weeks; mean CA=2 weeks, days).
Intervention. In the standard care condition infants were provided with the care that would normally be administered in the NICU following a heelstick procedure (e.g. pacifier, sensory stimulation). In the swaddling condition, following heelstick the infant was placed in a supine position and wrapped in a cloth in such a way that gross motoric movement was restricted. Both conditions were videotaped for 30 minutes, divided into 10 minute blocks of baseline, intervention, and recovery. For comparison purposes, all infants were videotaped for 30 minutes during which no medical intervention was administered.
Main Outcome Measures. Over the course of 3, 10-minute blocks, heart rate and blood oxygen level were measured every 60 seconds. Videotapes were also coded across 10-minute blocks, at 60 second intervals, for state of arousal (Brazelton, 1973) and facial action (NFCS, Gruneau & Craig, 1987).
Results. For both experimental and control conditions, facial action and arousal reached a peak within 1 minute of heelstick. Within 2 minute of heelstick heart rate increased and oxygen saturation decreased. Both experimental and control conditions yielded increases in facial action ($p<0.05$), state ($p<0.01$), and heart rate ($p<0.01$) during heelstick that were significantly different than the comparison period. During recovery, facial action in the control condition was significantly greater than in the experimental condition or comparison period ($p<0.01$). Facial action during swaddling did not differ from facial action displayed in the control period and there was a trend toward a greater effect of swaddling for older infants. State of arousal in both experimental and control conditions differed significantly from that of the comparison period ($p< 0.01$), with state scores dropping over the course of the recovery period. State scores declined more rapidly for older infants in the experimental condition. Heart rate returned to baseline most rapidly for older infants in the experimental condition ($p<0.01$).
Conclusions. Although all infants exhibited physiological and behavioural responses to heelstick, the recovery period and return to baseline measures differed. Swaddling interventions appear more effective for older infants (31 weeks or more PCA) than younger infants. Differences in recovery may reflect differences in neural integration. Findings support routine swaddling of infants older than 31 weeks PCA in order to facilitate recovery from invasive procedures.

Johnston, C.C., Stremler, R.L., Stevens, B.J. & Horton, L.J. (1997). Effectiveness of oral sucrose and simulated rocking on pain response in preterm infants. *Pain*, 72, 193-199.

Objective. To determine the effectiveness of sucrose alone, simulated rocking alone, and a combination of both on reducing pain response during heel lance.
Design. Randomized controlled trial.
Setting. Neonatal intensive care unit (NICU).
Participants. Eighty-five infants (43 female; mean gestational age=31 weeks; mean weight=1655 g; mean Apgar=8.2) randomly assigned to 1 of 4 treatment conditions. There were no differences between groups.
Intervention. The 4 interventions were Sucrose, Rocking, Combined (sucrose and rocking), and Placebo. For the Placebo group, infants were handled and positioned to be supine. Just prior to heel-stick, 0.05 ml of sterile water was ejected onto the infant's tongue from a 1 ml syringe. For the Sucrose intervention the procedure was the same, except the infants were given 24% sucrose solution. In the Rocking condition, infants were handled, positioned and wrapped in a flannel blanket, and placed on an oscillating mattress (i.e. air pumping into the mattress at a rate of 12 cycles/min) for 15 minutes prior to heel-stick. Immediately preceding heel-stick the infant was given 0.05 ml of sterile water. In the Combined group, infants were administered all the conditions of the Rocking group, and also received 24% sucrose solution.
Main Outcome Measures. The outcome measures used were physiological (heart rate and oxygen saturation) and behavioural (Neonatal Facial Action Coding System). A chart review was used to determine severity of illness as a function of the neonatal acute physiology score (SNAP-PE).
Results. Data were analysed in 3, 30 second blocks

following the heel-stick procedure. Sucrose alone, or with rocking, was effective in reducing facial expressions of pain after the first 30 seconds. Although the difference between the Sucrose group and the Combined group did not reach significance, there was a trend toward decreased facial expression of pain with the addition of rocking. An overall multivariate effect of intervention was found, for facial action, across phases of the procedure ($p<0.02$), with gestational age a significant covariate ($p<0.005$). Multivariate group effects were significant ($p<0.03$) as were the univariate analyses for each facial action (brow bulge, $p<0.005$; eye squeeze, $p<0.01$; naso-labial furrow, $p<0.01$). Significant differences were found between the Sucrose and Combined groups versus Rocking or Placebo. Heart rate increased across the procedure, but there were no significant differences between groups.

Conclusions. Preterm infants receiving 24% sucrose solution displayed less behavioural distress to the heelstick procedure than infants in the Placebo or Rocking groups. Sucrose paired with Rocking (Combined) was also effective in reducing the behavioural response to pain, however rocking alone was not sufficient to reduce the pain response, therefore it is most probable that the sucrose accounted for the effect in the Combination group. Although there are some limitations to the study (the research nurse conducting the heelstick was not blind to conditions and, as well, prepared the infants for each condition), data support the effectiveness of sucrose in reducing pain responses to heelstick procedures in preterm infants. Future research should assess dosing and maternal proximity (in place of simulated rocking).

Commentary

Infants have been swaddled and rocked from the beginning of human existence. Even the great apes hold infants in swaddled position and rock them (see, for example, Manning, 1990). Only recently has this natural behaviour been studied systematically and there are few studies that evaluate the effectiveness of these strategies to reduce pain, in spite of the fact that it is a strategy mothers and adult care givers use to comfort infants.

A mother (or adult care giver) who rocks an infant is employing three strategies simultaneously: 1) by swaddling or cradling the infant, the limbs are maintained in a mid-line position, which promotes physiological stability and behavioural organization (Als et al., 1986; Short et al., 1996); 2) by rocking, the vestibular system is activated which promotes quiet state (Korner et al., 1972; Korner et al., 1990), and 3) by holding the infant closely, warmth and regulating breathing patterns are provided (Ludington, 1990; Sammon et al., 1994). It is the first two components alone or in combination, that is, swaddling and rocking, that have been investigated as methods to reduce pain response.

The combination of rocking and swaddling was compared to pacifier in full-term infants in Campos' (1994) study and compared to sucrose in preterm infants in the study by Johnston and colleagues (1997). In the full-term study, the infants were held on the experimenter's shoulder and rocked at a frequency of 30 cycles/minute. Swaddling is not mentioned, although the infant would have to have been cradled to some extent in order to maintain the position. Thus, this natural rocking intervention utilized all three strategies (i.e. promoting midline position, vestibular action, and closeness). This mechanism was successful in decreasing amount of crying, but not heart rate, during the eight minutes of heelstick procedure and the eight minutes after the actual heelstick.

None of the preterm studies used natural rocking. The Johnston et al. (1997) study used simulated rocking with the infant swaddled in blanket and placed on a vertically oscillating air mattress at 12 cycles/minute. This strategy employed two components of rocking, swaddling and vestibular action. This strategy by itself was ineffective in reducing any parameters of pain response measured over the two minutes of the procedure. Age was a significant co-variate in that study. In the study by Fearon et al. (1997), the infant remained in the isolette in the swaddled condition and monitoring continued for 10 minutes beyond the actual heelstick procedure. Younger (PCA<31 weeks) and older (PCA>31 weeks) were compared. There was a non-significant trend for swaddling to be effective for heart rate and facial activity in the post-heelstick phase for the older infants only, whereas oxygen saturation levels were higher for younger infants in the swaddled condition. In the Corff et al (1995) study, preterm infants were held by a nurse's hands in a way that brought the infant's limbs into mid-line position, a method referred to as 'facilitated tucking'. Infants as young as 25 weeks PCA were included in the study. In the post-heelstick recovery phase, there was a significant decrease in heart rate and crying in the facilitated tucking position. Analysis of age was not included.

When the results of these studies are taken together, it would seem that maintaining the infant in a midline position by means of swaddling or facilitated tucking may be helpful in promoting recovery following a minor invasive procedure, such as heelstick. Johnston et al. (1997) did not

continue monitoring into the post-heelstick recovery period, but the other studies which did found a difference consistently during that period. Comparisons are difficult in that there were differences in the methodologies of the studies, including different ages, which were controlled for by selection (Campos, 1994) or analysis (Fearon et al., 1997; Johnston et al., 1997), differences in monitoring time, and differences in actual strategies (maintaining midline position, adding vestibular action, the orientation of the infant as either supine, side, or upright). Future studies should have several conditions in a cross-over design with infants of a wide age range in order to determine if swaddling alone is effective and what the addition of vestibular action and caregiver closeness is. Until such time, swaddling, which is not harmful and seems to facilitate recovery, would appear to be a worthwhile intervention for reducung pain response in infants.

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Announcements

Meetings

August 22-27, 1999: *9th World Congress on Pain, Vienna, Austria, the Triennial Scientific Meeting of the International Association for the Study of Pain.* The Congress is open to those working in or interested in any aspect of pain, including research and treatment, and features leading world experts in each field. For further information, contact the IASP, 909 NE 42nd Street, Suite 306, Seattle, Washington, 98105, USA, tel (206) 547-6409, fax (206) 547-1703, e-mail IASP@locke.hs.washinton.edu or via the internet http://www.halycon.com/iasp

September 2-4, 1999: *4th International Congress on Headache in Childhood and Adolescence, Turku, Finland.* For further information contact the Congress Office/HCA, University of Turku, Lemminkäisenkatu 14-18 B, FIN-20520 Turku, Finland, fax +358-2-333-6410, tel +358-2-333-6345, or via e-mail: cescon@tkk.utu.fi.

October 21-24, 1999: *18th Annual Scientific Meeting of the American Pain Society, Fort Lauderdale, Florida.* The American Pain Society (APS) is a multi-disciplinary society composed of physician specialties and subspecialties, nursing specialities and subspecialities, psychologists, physical therapists, occupational therapists, dentists, neuroscientists, clinical investigators, and others interested in pain. Presentations of a multi-disciplinary nature are strongly encouraged. For further information contact the APS Education Department at (847) 375-4715 or the APS web site at http://www.ampainsoc.org/.

June 18-21, 2000: *ISPP2000 - The 5th International Symposium on Paediatric Pain, London, England, UK.* To take place at the Royal Lancaster Hotel. The programme will be made up of plenary lectures , as well as workshop and poster sessions by neuroscientists and clinicians. Focus will be on the integration of clinical management of children's pain with underlying developmental biology. For further information contact Meeting Makers, tel +44(0)141-434-1500, fax +44 (0) 141-434-1519, e-mail ispp2000@meetingmakers.cp.uk, or via website http://www.ich.ucl.ac.uk/pain2000/.

September 28-October 1, 2000: *3rd Biennial International Forum on Pediatric Pain, White Point Beach Resort, Nova Scotia, Canada.* The topic of the meeting will be acute and procedural pain. For further information contact Kate Finlayson of Conventional Wisdom, (tel) 902-453-4664, (fax) 902-423-5232, or via e-mail katefin@chebucto.ns.ca.

Publications

Chronic and Recurrent Pain in Children and Adolescents: Progress in Pain Research and Management, Vol.13. McGrath, P.J. & Finley, G.A. (Eds). IASP Press, Seattle, 1998, 288 pp. (hardbound), ISBN# 0-931092-27-2. Price: $43.55 US for IASP members, $67.00 US for non-members.

Announcement of Special Issue on Pediatric Pain. *Pain Research and Management* is pleased to announce a special issue on Pain in Infants, Children and Adolescents. We welcome data based articles, review articles and CME articles on any aspect of pediatric pain. We will also accept poetry or art submissions on the topic. The Guest Editors for this issue are Patrick J. McGrath of Dalhousie University and Christine Chambers of the University of British Columbia. The deadline for submission is January 15th. Review will follow the usual policies of the journal and will be rapid. Earlier submission will result in earlier review and acceptance. Accepted articles will be published in the special issue or, if numbers warrant, in other issues of the journal as well. Please submit articles following the guidelines for authors (available in each issue of the journal or through the journal website <http://www.pulsus.com>).

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Short announcements on pediatric pain events will be published free of charge.

If you would like to participate

Your participation in abstracting and writing commentaries for the *Pediatric Pain Letter* is welcomed. Please send submissions according to the specifications outlined in our Author's Kit. An Author's Kit can be obtained from Jill Hatchette, Managing Editor, *Pediatric Pain Letter*, Psychology Department, Dalhousie University, Halifax, Nova Scotia, B3H 4J1; email jhatchet@is.dal.ca; requests can be made in writing or by email. Abstracts and commentaries on any aspect of pain in infants, children, and/or adolescents are appropriate. We will attempt to use abstracts and commentaries but the editors reserve the right to edit or reject contributions.

Assistants for this issue: Rochelle Currie, Andrea Gregory.