Pain Experience and Pain Coping Strategies in Children with Juvenile Idiopathic Arthritis

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ABSTRACT. ***Objective.*** To compare reactions to cold pressor pain and pain coping strategies of patients with juvenile idiopathic arthritis (JIA), healthy children, and their parents.

Methods. We studied 16 children with JIA and one of their parents and 14 healthy children and one of their parents. Patients with JIA were selected from the patient population by fulfilling criteria for inclusion in a "high pain" group (n = 7) of patients with modest clinical arthritis activity, but who presented daily reports of pain in connection with everyday activities, and a "low pain" group (n = 9) who presented significant clinical arthritis activity, but who had only a few complaints of pain related to everyday activities. Dependent variables included pain threshold, discomfort, intensity and tolerance to cold pressor pain, and pain coping strategies.

Results. Patients with JIA exhibited significantly lower mean pain tolerance than healthy children. Disease duration correlated with both experimental and clinical pain measures, and JIA patients used significantly more Behavioral Distraction than healthy children. Correlations were found between children's and parents' use of Approach and Distraction related coping strategies. Correlations were also found for the coping strategy of Catastrophizing in the JIA patient group. For experimental pain coping strategies, a significant correlation was found between the JIA patients' and their parents' use of Distraction. For the JIA patients Positive Self-statements and Behavioral Distraction were inversely correlated with the clinical pain measures. In both children and parents the experimental pain coping strategies of Catastrophizing and Distraction were associated with the experimental pain response measures, and low pain JIA patients tended to use more Distraction pain coping strategies than high pain patients.

Conclusion. The results indicate that JIA patients may differ from healthy children with regard to their responses to experimental pain as well as to their use of pain coping strategies. Pain coping strategies of JIA patients were associated with pain coping strategies of their parents, and use of pain coping strategies was associated with both experimental and clinical pain experience. (J Rheumatol 2001;28:1091–8)

Key Indexing Terms:
JUVENILE IDIOPATHIC ARTHRITIS COLD PRESSOR PAIN
COPING PARENTS PAIN

Although juvenile idiopathic arthritis (JIA) is one of the most common chronic diseases with childhood onset, our knowledge about pain experience and pain management is limited. There has been disagreement with respect to the amount of pain experienced by children with JIA, a disagreement that may be due to the difficulties involved in measuring pediatric pain. Some investigators have reported that children with JIA experience substantially less pain than adults with rheumatoid arthritis (RA)[1,2], while others, who have included developmental differences in the pain experience, have found that children with JIA were able to describe painful sensations in their joints in a manner similar to adults with RA[3]. There have also been contradictory results with respect to the relationship between disease activity and pain experience in the child with JIA. Some investigators[4] have found correlations between disease activity and the child's pain ratings, while others have been unable to find correlations between the child's pain ratings and physician rated disease activity[5], or between the child's pain rating and joint temperature[6]. In addition, Gragg, *et al*[7] found that psychosocial factors may be better predictors of the children's pain rating than disease activity. Thus, disease activity only partly explains the variation in the pain experience of patients with JIA, and it is possible that psychosocial factors could contribute substantially to the child's pain perception.

One possible psychological mediator of pain perception is the use of pain coping strategies. In studies of patients with RA, active coping strategies, e.g., Cognitive and Behavioral Distraction, have been found to be associated with less pain[8], and belief in the ability to control pain and

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less use of the coping strategy of Catastrophizing has been associated with less pain after knee operations[9]. In adults with a variety of chronic pain conditions, coping strategies have been found to be modest, but significant, predictors of pain levels[10]. Research in coping strategies of children has been limited by the lack of a suitable pain coping questionnaire for children. Recently, however, 2 pain coping questionnaires for children have been developed[11,12].

In a review of studies of family functioning and outcome in patients with RA, Nicassio and Radojevic[13] conclude that family variables may influence the pain perception of the patients, but only a few studies have investigated the possible influence of family functioning on pain perception in children with JIA. It has been suggested that pain experience and use of pain coping strategies in children with JIA are associated with family functioning and the pain coping strategies of their parents. Ross, *et al* found a positive association between family harmony and reported pain[14], and Timko, *et al* found that the child's pain perception was related to alcohol problems of the father[15]. With respect to the relationship between parental and child pain coping strategies, only a few studies have addressed this issue. In a study of children with sickle cell syndrome, Gil, *et al* found a positive correlation between the use of the pain coping strategy referred to as passive adherence in parents and children, and also found that mothers using more active coping strategies had children who endorsed significantly less negative thinking[16]. Contrary to this finding, Sharpe, *et al*, found no associations between maternal and child coping strategies, a finding that could be due to the small sample studied[17]. The contradictory results of these studies could also be related to the different types of pain coping questionnaires used.

We have reported that patients with JIA exhibited lower experimental pain tolerance than healthy children and that the coping strategy of Catastrophizing was associated with several of the experimental pain response measures studied[18]. We also found correlations between pain scores of children and their parents for both experimental pain intensity and tolerance. Contrary to our hypothesis, however, our results did not reveal any associations between the pain coping strategies of children and their parents. This finding could perhaps be explained by the unavailability of a validated pain coping questionnaire for children at the time.

In this study we aimed to replicate our findings concerning the relationship of the pain responses of the children and their parents. Since a validated pain coping questionnaire for children is now available[12,19], we also wanted to test the hypothesis that the pain coping strategies of children and their parents are related to each other. We expected to find a positive association between the use of the coping strategy of Catastrophizing and the intensity of clinical end experimental pain, as well as an inverse association between the use of active cognitive and behavioral pain coping strategies and the intensity of clinical end experimental pain. Finally, we hypothesized that a group of JIA patients with history of greater pain and a group with less pain than would be expected from their disease activity would differ from each other with respect to their reactions to experimental pain and their use of pain coping strategies.

MATERIALS AND METHODS

Subjects. Sixteen children (10 girls, 6 boys; mean age 12.4 ± 2.6 yrs) with JIA according to the ILAR criteria[19a] and one of their parents (mother or father) were recruited for the study. Except for one father, all parents were mothers. Ten patients had oligoarticular onset arthritis, of which 6 had the extended type. Two had rheumatoid factor (RF) negative polyarthritis, one had systemic disease, and 3 had enthesitis related arthritis. The mean disease duration was 77 ± 34 months. Fourteen healthy children (8 girls, 6 boys, mean age 14 ± 1.6 yrs) and one of their parents (mother or father) served as a control group. All parents were mothers. The patients were recruited at the Pediatric Rheumatology Clinic of the Department of Pediatrics, Aarhus University Hospital. The healthy children were recruited from an elementary school in the vicinity of the hospital.

The patients were selected from the outpatient clinic by fulfilling the criteria for inclusion in one of the 2 following groups:

1. Criteria for patients with "high pain" were (1) disease activity for more than one year; (2) daily reports of pain within the last month not controlled by nonsteroidal antiiflammatory drugs (NSAID) — naproxen (10 mg/kg/day) or piroxicam (0.4 mg/kg/day); (3) erythrocyte sedimentation rate (ESR) < 20 mm/h within the last year; (4) no more than 2 active joints (swollen joints or joints with pain and limitation of motion). High pain patients consisted of 7 patients (5 girls, 2 boys). Clinical characteristics are shown in Table 1. Five patients had oligoarticular onset arthritis, 2 had enthesitis related arthritis. Two patients had joint effusion, but only in one single joint. Three patients had joint tenderness and pain on movement.

2. Criteria for patients with "low pain" were (1) disease activity more than one year; 2) pain controlled by NSAID — naproxen (10 mg/kg/day) or piroxicam (0.4 mg/kg/day); (3) ESR > 30 mm/h within the last year; (4) more than 3 active joints. Low pain patients consisted of 9 patients (5 girls, 4 boys) (Table 1). There were 5 patients with oligoarticular onset arthritis: 3 had the extended type, one the systemic type, 2 polyarticular type, and one had enthesitis related arthritis. At time of investigation all patients had swollen joints (2–13 joints).

The high pain patients did not differ significantly from the low pain patients with regard to age (high pain 13.4 ± 2.7, low pain 11.6 ± 2.2 yrs; p = nonsignificant) or disease duration (high pain 62 ± 47, low pain 81 ± 37 months; p = NS).

Visual analog scale (VAS) scores were not used before assignment to groups, but were used for assessment of pain activity during the study.

Eligible patients were contacted by their rheumatologist to ascertain their interest in participating in the study. All children were given written and verbal information about the project, and all children and parents gave informed consent. The healthy children were offered 50 DKr (about $10 US) for their participation. The study was approved by the local ethics committee.

Experimental procedure. All subjects participated individually in the experimental sessions. The instructions given to the subjects were standardized by using a manuscript prepared in advance. If required to meet the comprehension level of the child additional instructions were given. The patients and their parents were examined at the Institute of Psychology, University of Aarhus. The healthy children and parents were examined at the elementary school from which they were recruited. The children and their parents first completed the experimental pain procedure, and were then asked to complete self-report questionnaires. Parents and children were examined and completed the questionnaires separately.

Experimental pain. Experimental pain was induced using a cold pressor

Table 1. Clinical differences between patients in the High pain and Low pain groups.

	F/M	Duration of Disease, mo	ESR, mm/h	HB, mmol/l	Joint Activity		ANA+	RF+	B27+
					Active	Swollen			
High pain (n = 7)	5/2	62 ± 47	7.4 ± 5.8	7.9 ± 0.4	0.9 ± 1.4	0.3 ± 0.4	1	0	2
Low pain (n = 9)	5/4	81 ± 37	11.9 ± 10.8	7.5 ± 0.9	6.3 ± 3.8	4.0 ± 3.6	6	0	1

ANA: patients with antinuclear antibody titer > 1:40; RF+: IgM RF positive > 20 IU/ml; B27+: presence of tissue antigen HLA-B27.

pain method, which has been used in experimental pain research with both adults and children[18,20-24]. The subjects were instructed to submerge their nondominant hand in ice water with a constant temperature of 6°C for children and 1°C for adults.

Pain measures

Measurements of experimental pain perception. We measured 4 dimensions of experimental pain perception: pain threshold, pain tolerance, pain intensity, and pain discomfort. The pain threshold is defined as the minimum amount of stimulation that reliably evokes a report of pain. Pain tolerance is defined as the time that a continuous stimulus is endured. Pain threshold and pain tolerance are unidimensional pain measurements. The response is expressed in time, avoiding the subjectivity of a psychological pain scale. Measurement of pain intensity and pain discomfort assumes that subjects can meaningfully quantify the evoked sensation on a psychological scale of pain magnitude. As well, they intend to measure the dual dimension of pain as both a somatic sensation and a feeling state[25].

Pain intensity. Pain intensity was measured using an Electronic Visual Analogue Scale (EVAS) connected to a computer[20]. In the hand not submerged in the ice water the subjects held a potentiometer constructed so that they could easily move a button up and down according to their pain experience. A scale on the potentiometer indicated minimum as "no pain" and the maximum as "maximum pain." Pain intensity was measured and stored in the computer at 6 second intervals during the first 2 minutes of the pain induction. Before the experiment the subjects were instructed in the use of the EVAS. They were then given the following instructions: "You must now try to keep your hand in the water as long as you can. After a while the computer will beep. I will then ask you to continue to keep your hand submerged in the water as long as you can, but you are not required to measure the pain on the electronic scale any longer." The data were analyzed and the mean pain intensity and the pain threshold were calculated for each subject[18].

Pain tolerance. Pain tolerance was measured as the total time (in seconds) the hand was submerged. After 5 minutes the subjects were asked to retract their hands from the ice water, if they had not done so already.

Pain discomfort. After subjects had retracted their hand from the ice water, they were asked to rate the discomfort after 2 minutes or at the time they had retracted their hand if they had done so before 2 minutes. A numeric rating scale was used, with numbers from 0 to 10, with "0" indicating no discomfort and "10" indicating maximum discomfort.

Pain threshold. Pain threshold was measured as the time (in seconds) when the subject began to move the button of the potentiometer.

Clinical pain measurement. The patients' and parents' perceptions of the patients' clinical pain were assessed with the Varni/Thompson Pediatric Pain Questionnaire (PPQ)[4,26]. The PPQ is a comprehensive instrument modeled after the most widely used adult pain assessment instrument, the McGill Pain Questionnaire[27], designed to be sensitive to the cognitive-developmental conceptualization of children. The PPQ includes a form for children, adolescents, and parents. The intensity of clinical pain was measured using visual analog scales. Patients were asked to rate (1) how much pain they experienced at the present time, (2) on average each day, and (3) the worst pain in the previous week, by indicating on a 10 cm horizontal line with no numbers, anchored with the pain descriptors "no pain" and "severe pain." Additional descriptors were "no hurting," "hurting," "no discomfort," and "discomfort." Studies suggest that the PPQ-VAS is a reliable and valid measure of pediatric pain intensity[4,28].

Coping measures

Experimental pain coping strategies. To measure the pain coping strategies used to cope with the experimental pain induction, an Experimental Pain Coping Questionnaire was developed using a revised version of the Pain Coping Questionnaire[18,29,30]. The reliability coefficients (Chronbach's alpha) of the subscales were calculated for children and parents separately. The subscales of Ignoring Pain Sensations and Praying and Hoping did not reach an acceptable reliability, and were excluded from further analysis. The reliability of the subscales of (1) Distraction, (2) Reinterpretation of Pain Sensation, and (3) Catastrophizing was considered acceptable, with coefficients ranging from 0.63 (Reinterpretation of Pain Sensation) to 0.82 (Distraction), and were included in the analysis.

Clinical pain coping strategies. All children completed the Danish version of the Pain Coping Questionnaire (PCQ)[12]. The PCQ has preliminary validation with Danish children[19]. The children indicated how often (1 = never, 2 = hardly ever, 3 = sometimes, 4 = often, 5 = very often) they used each of the 36 coping strategies in response to the prompt, "When I am hurt or in pain for a few hours or days, I...". The Danish version of the PCQ consists of 36 items and 7 subscales: (1) Information seeking and problem solving (e.g., Learn more about how my body works; figure out what I can do about it), (2) Seeking social support (e.g., Talk to someone about how I am feeling), (3) Positive Self-statements (e.g., Tell myself it's not so bad), (4) Behavioral Distraction (e.g., Do something I enjoy), (5) Cognitive Distraction (e.g., Try to forget it), (6) Externalizing (e.g., Say mean things to people), and (7) Internalizing/Catastrophizing (e.g., Worry that I will always be in pain).

All parents completed a Danish adaptation of a recent version of the Coping Strategy Questionnaire (CSQ)[29,31]. Parents indicated to what extent they used each of the 31 coping strategies on a 1 point ("not at all") to 6 point ("always") scale in response to the question, "How often do you do what the item describes when you are in pain." The CSQ consists of 31 items and 5 subscales: (1) Distraction, (2) Ignoring sensations, (3) Reinterpreting sensations, (4) Catastrophizing, (5) Praying and hoping. The reliability coefficients (Chronbach's alpha) of the subscales ranged from 0.66 (Catastrophizing) to 0.88 (Distraction), which was considered acceptable.

Data analysis. To compare pain responses between groups the t test for independent samples was used. The data were tested for normality with the One-Sample Kolmogorov-Smirnov test. The results for all variables were > 0.05 (range 0.07–0.88). We can therefore assume that the variables are normally distributed. However, because of the small cell sizes we performed nonparametric tests (Mann-Whitney U test for 2 independent samples) on the data as well. The results were similar to results obtained with the t test for independent samples. Bonferroni corrections were used to control for error due to multiple analyses. Post-hoc power analyses were conducted to control for possible Type II errors due to the relatively small sample size. To compare pain coping strategies between patients with high

and low pain t tests for independent samples were used. Correlations were calculated with the Pearson product-moment correlation coefficient.

RESULTS

Comparing pain responses

A significant difference was found between the mean pain tolerance of patients with JIA (n = 16, 120 ± 104) and healthy children (n = 14, 227 ± 100) ($p < 0.01$). Differences for the other 3 pain measurements did not reach statistical significance. No statistical differences were found between patients with low and high pain.

Associations between age, pain responses, and disease duration. As shown in Table 2, we found a significant partial correlation between pain discomfort and age for patients when controlling for disease duration. No correlations between age and any of the other 3 pain response measures were found. No correlations were found between age and pain responses in healthy children. When controlling for age, a significant correlation between disease duration and pain intensity, and pain discomfort and worst pain previous week was found for patients. No correlations between disease duration and any of the other 3 pain response measures were found.

Coping strategies

Experimental pain coping strategies. The mean scores of the experimental pain coping subscales of Distraction, Reinterpreting Pain Sensations, and Catastrophizing were compared for patients and healthy children, for high and low pain patients, for parents of patients and parents of healthy children, and for parents of high and low pain patients, respectively. Parents of patients used less Catastrophizing (0.36 ± 0.35) than parents of healthy children (0.70 ± 0.32) ($p < 0.05$). No other significant differences were found.

Clinical pain coping strategies of children. We found a significant difference between the scores of healthy children and patients for Behavioral Distraction — healthy children: 2.5 ± 0.7, patients: 2.8 ± 1.0 ($p < 0.02$). No other differences between healthy children and patients reached statistical significance. A significant difference ($p < 0.01$) was found between high and low pain patients for the Behavioral Distraction subscale — high pain patients: 1.9 ± 0.7, low pain patients: 3.3 ± 0.6; no differences were found for any other subscales. Calculating the effect size (d)[31], the differences between high and low pain patients yielded moderate to high effects for the subscales of Cognitive Distraction (d = 0.78) and Information Seeking/Problem Solving (d = 0.63). Subsequent power analysis revealed that a modest increase of the number of the subjects to 2×27 and 2×41, respectively, would yield significant results with a power of 80% (alpha = 0.05). The data are presented in Table 3.

Correlations between clinical pain coping strategies of children and parents. For JIA patients and their parents, significant correlation coefficients were obtained between parents' use of Distraction and Reinterpreting Pain Sensations and patients' use of Seeking Social Support; between parents' use of Ignoring Pain Sensations and patients' use of Positive Self-statements and Cognitive Distraction; and between parents' use of Catastrophizing and patients' use of Externalizing and Internalizing/Catastrophizing. The results are shown in Table 4.

Correlations between coping strategies and pain responses. A series of Pearson product-moment correlation coefficients were computed to determine the associations among clinical pain experience and clinical pain coping strategies of the patients, and experimental pain experience and experimental pain coping strategies of the patients and the healthy children.

For patients, significant inverse correlation coefficients were obtained between all 3 clinical pain measures and the coping strategies of Positive Self-statement and Behavioral Distraction of the PCQ. Thus, greater use of these coping strategies was associated with reports of less clinical pain. Tolerance to experimental pain was significant correlated with the experimental pain coping strategy of Distraction. For the healthy children a significant inverse correlation coefficient was found between the experimental pain coping strategy of Catastrophizing and tolerance to experimental pain. The results are shown in Tables 5 and 6.

Table 2. Pearson correlation coefficients between age and pain responses of patients and healthy children and between disease duration and the pain responses of patients.

R	N	Pain Threshold	Pain Intensity	Pain Tolerance	Pain Discomfort	Pain Just Now	Average Pain Every Day	Worst Pain During Last Week
Age (patients)⁺ (controlling for disease duration)	16	0.04	0.27	–0.09	0.67*	0.23	0.35	0.54
Age (healthy children)	14	0.51	–0.12	–0.20	0.09			
Disease duration (patients)⁺ (controlling for age)	16	0.37	–0.70**	0.53	–0.85**	–0.29	–0.54	–0.66*

⁺: Partial correlation coefficient. *$p < 0.05$; **$p < 0.01$.

Table 3. Comparison of scores of the Pain Coping subscales of patients with high and low pain (T test).

PCQ Pain Coping Measure	Patients Low Pain, (N = 9)	Patients High Pain, (N = 7)	p (t test) p	p (t test) Adjusted (Bonferroni Method)	Power Analysis Power	Power Analysis Required (2 × N) with alpha = 0.05 and power = 0.80	Power Analysis Required (2 × N) with alpha = 0.05 and power = 0.80 Adjusted
BD	3.3 ± 0.6	1.9 ± 0.7	0.001	0.01	0.80	5	8
CD	3.8 ± 1.0	2.9 ± 1.3	0.148	—	0.28	27	45
IP	2.5 ± 0.8	2.0 ± 0.8	0.258	—	0.20	41	68
PSS	3.2 ± 1.1	2.8 ± 1.2	0.470	—	0.02	131	215
SSS	2.9 ± 0.6	2.7 ± 1.0	0.595	—	0.01	268	440
EXT	1.4 ± 0.6	1.5 ± 0.7	0.970	—	0.01	668	1097
INT	1.9 ± 1.0	1.8 ± 0.8	0.813	—	0.01	1288	2115

BD: Behavioral Distraction, CD: Cognitive Distraction, IP: Information Seeking and Problem Solving, PSS: Positive Self-statement, SSS: Seeking Social Support, EXT: externalizing, INT: internalizing/catastrophizing.

Table 4. Pearson correlation coefficients between the coping strategies of parents of JIA children and JIA children, parents of high pain JIA children and high pain JIA children, and parents of low pain JIA children and low pain JIA children.

Parents of JIA children CSQ), n = 16/16	JIA Children (PCQ) PSS	BD	CD	EXT	INT
Distraction	0.01	0.19	0.22	–0.04	0.36
Reinterpreting Pain Sensations	–0.05	0.14	0.09	0.01	0.06
Ignoring Pain Sensations	0.53*	0.27	0.72**	–0.44	–0.29
Praying and Hoping	0.14	0.25	0.03	0.41	0.51*
Catastrophizing	–0.09	0.11	–0.35	0.82**	0.66**
Parents of High Pain JIA children (CSQ), n = 7/7					
Distraction	0.53	0.72	0.57	–0.31	–0.01
Reinterpreting Pain Sensations	0.20	0.44	0.44	–0.47	–0.19
Ignoring Pain Sensations	0.49	–0.22	0.59	–0.89**	–0.55
Praying and Hoping	0.15	0.63	0.25	–0.16	–0.12
Catastrophizing	–0.43	0.41	–0.53	0.84*	0.54
Parents of Low Pain JIA children (CSQ), n = 9/9					
Distraction	–0.40	–0.51	–0.19	0.19	0.58
Reinterpreting Pain Sensations	–0.27	–0.24	–0.32	0.45	0.22
Ignoring Pain Sensations	0.56	0.46	0.84**	0.10	–0.14
Praying and Hoping	0.12	0.10	–0.15	0.80**	0.84**
Catastrophizing	0.17	0.03	–0.19	0.80**	0.75*

*p < 0.05; **p < 0.01. PCQ; Pain Coping Questionnaire, CSQ: Coping Strategy Questionnaire, PSS: Positive Self-statements, BD: Behavioural Distraction, CD: Cognitive Distraction, EXT: Externalizing, INT: Internalizing/Catastrophizing.

DISCUSSION

In accord with the results of our previous study, we found that disease duration was a better predictor than age of both experimental and clinical pain experience in patients with JIA. Patients with longer disease duration tended to experience a lower degree of experimental pain intensity, experimental pain discomfort, clinical average pain every day, and worst pain during last week. Alhough the results were not statistically significant, the patients also tended to endure experimental pain longer. In the control group of healthy children we found no significant correlations between age and any of the experimental pain response measures. Several other studies also found that age is unable to predict pain intensity in JIA[5,32-34]. Our finding that pain discomfort

Table 5. Pearson correlation coefficients between the patients' clinical pain experience and the Pain Coping subscales.

VAS Scales Pediatric Pain Questionnaire	IP	SSS	PSS	BD	CD	EXT	INT
JIA patients, n = 15							
Pain just now	–0.33	–0.16	–0.73**	–0.63**	–0.42	0.02	–0.07
Average pain every day	–0.34	–0.08	–0.62*	–0.69**	–0.48	–0.07	–0.02
Worst pain during last week	–0.24	–0.01	–0.53*	–0.58*	–0.38	0.03	0.04

*p < 0.05, **p < 0.01. IP: Information Seeking/Problem Solving, SSS: Seeking Social Support, PSS: Positive Self-statements, BD: Behavioral Distraction, CD: Cognitive Distraction, EXT: Externalizing, INT: Internalizing/Catastrophizing.

Table 6. Pearson correlation coefficients between the experimental pain experience and the Experimental Pain Coping subscales of patients and the healthy children.

VAS scales. Experimental pain	Exp DIST	Exp REIN	Exp CAT
JIA patients, n = 16			
Pain tolerance	0.57*	–0.06	–0.36
Pain intensity	–0.18	–0.07	0.48
Pain discomfort	–0.09	–0.08	0.16
Pain threshold	0.48	0.11	–0.22
Healthy children, n = 13			
Pain tolerance	0.43	–0.26	–0.58*
Pain intensity	0.03	–0.06	0.42
Pain discomfort	–0.46	0.17	–0.25
Pain threshold	0.25	0.26	0.04

*p < 0.05. DIST: Distraction, REIN: Reinterpretation of Pain Sensation, CAT: Catastrophizing.

increased with age is in agreement with a study by Beales, *et al*[35], and could be explained by the greater awareness of older children of the consequences of their disease and that they therefore associate their pain with more negative emotion. Another explanation could be that younger children are less able than older children to separate pain intensity from pain discomfort[36]. Considering these findings, it seems that the duration of disease is a more important predictor of pain than age. Others found similar results[37], which could be explained by increased use of adaptive pain coping strategies with longer pain experience.

Our results showed that the group of healthy children was able to endure experimental pain longer than the group of patients with JIA. No differences were found for any of the other pain measures. This is a replication of our previous results and suggests that subjectively perceived pain intensity and pain discomfort are not directly related to pain tolerance. It is possible that pain tolerance, defined as the maximum noxious stimulation the subject can tolerate, is more physiologically loaded than pain intensity and pain discomfort, measures that are subjectively rated on a VAS scale. Pain tolerance could therefore be more closely related to pain threshold, which generally is thought to be a sensory event that is more physiologically than psychologically loaded[26], and is a measure that has been shown to be lower in patients with JIA compared to healthy children[38,39]. Our results could therefore be interpreted as supporting the hypothesis that experience with recurrent pain sensitizes children to future stimulation.

We previously found correlations between experimental pain intensity and pain tolerance in children and parents[18]. Since, to our knowledge, this has not previously been investigated, we wanted to test whether we would be able to replicate the results. In the present study we found associations between pain intensity in healthy children and low pain JIA patients and their parents, and between pain discomfort in healthy children and their parents. With respect to these measures the results confirm the findings from our previous study[18]. However, we found no associations between pain tolerance of low pain JIA patients and healthy children and their parents, but did find correlation between high pain JIA patients and their parents for this measure. The discrepancy between the previous and present results could be due to the small number of subjects available who fulfilled the inclusion criteria. Another explanation may be that a real difference exists between low pain JIA patients and healthy children on one hand and high pain JIA patients on the other with respect to their relationship to their parents. The present data give us no ready explanation for the differences between the groups with respect to pain tolerance.

Similarly to our previous study[18], we found no differences between the JIA patients and the healthy children in use of experimental pain coping strategies. We did find, however, that the JIA children tended to use higher levels of the clinical pain coping strategy of Distraction than the healthy children; this is in agreement with others' findings[40] that children with JIA tend to use general coping strategies more often than healthy children. One explanation could be that, due to their illness, children with JIA have greater experience with the use of coping strategies.

The coping behavior of children might be related to the coping behavior of their parents through social learning mechanisms. According to a social learning model of

coping, parents provide the model through which a child learns to cope[16,41]. For pain coping strategies not related to the experimental pain, but to pain in general, we found significant correlations between the child and the parent's use of Approach and Distraction related coping strategies. This was also the case for Catastrophizing coping strategies in the patients with JIA.

Our results thus confirm our hypothesis concerning a relationship between the pain coping strategies of children and their parents, and the results are consistent with those of Gil *et al*[16], who found that mothers who scored highly on active coping strategies had children who endorsed significantly less negative thinking.

In patients with JIA, the general pain coping strategies of Positive Self-statements and Behavioral Distraction were, as predicted, inversely correlated with all 3 clinical pain measures, which could indicate an association between greater use of Approach and Distraction pain coping strategies and lower experience of arthritis related pain. Unexpectedly, we found no association between Catastrophizing and Externalizing (emotion focused avoidance strategies) and arthritis related pain experience. In contrast to our results, Reid, *et al*[12] found that emotion focused avoidance strategies were positively associated with arthritis related pain intensity in a sample of patients with JIA, but they found no association between pain intensity and Approach and Distraction strategies. They argue that emotion focused avoidance strategies may reflect a coping trait in contrast to Approach and Distraction strategies, which may be used in response to specific types of pain. In their study the children completed the pain coping questionnaire *before* they rated their pain in a diary every day for 2 weeks. In our study the children completed the questionnaire and rated their pain retrospectively on the same day. This methodological difference could perhaps explain why pain coping strategies are more closely related to the arthritis related pain experience of patients in our study than in the Reid study.

In agreement with our findings, Varni and associates, in a sample of patients with JIA, found an inverse association between the use of the pain coping strategy of Cognitive Refocusing and patient reported worst pain during the last week[4]. They used the same methodology as in this study, i.e., they measured coping strategies and pain experience immediately after each other.

As expected and in agreement with our previous results, we found reduced tolerance and threshold to pain, and greater intensity of pain, in subjects who tended to respond with Catastrophizing. This was the case for both children and parents. We also found an association between greater use of the experimental pain coping strategy of Distraction and higher ability to endure experimental pain as well as lower pain intensity. We have no ready explanation why we found no association between the clinical pain measures and Catastrophizing. It could, however, be explained by our use of 2 different questionnaires to measure clinical and experimental pain coping strategies.

We found no differences between high and low pain patients' use of experimental pain coping strategies. However, assessing general pain coping strategies, low pain patients were shown to use more Distraction and Information Seeking/Problem Solving strategies than the high pain patients. Among children and adolescents, Distraction is generally found to be an efficient coping strategy in acute pain[42-44]. In children with chronic pain conditions, Distraction and Approach coping strategies have been found to be associated with better adjustment and less pain[12,45-47]. Our findings could indicate that the higher use of Distraction coping strategies in the group of patients with low pain explains their lesser degree of reported pain, and that the use of this strategy thus is an adaptive way of managing arthritis related pain. However, since this is a correlational study we cannot, of course, infer a causal relationship. Another explanation could therefore be that it is easier for patients with low pain to use Distraction coping strategies due to less pain. High pain patients could be so overwhelmed by their pain that they are unable to use distraction strategies.

The clinical implications of our results are that it could be important to provide sufficient pain treatment of children if pain sensitization is to be avoided, and that educating patients with juvenile arthritis and their parents in the use of appropriate pain coping strategies could be a beneficial addition to standard treatments. Only a few studies have investigated the effect of psychological pain treatment on patients with JIA[48,49]. The studies indicate a positive effect of psychological pain treatment, but they are limited by the small number of subjects and by not including control groups. There is a need for investigations of the effects of psychological interventions and education on pain and pain coping in juvenile arthritis that include control groups and a sufficient number of subjects.

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