Attachment and Pain Outcomes in Adolescents: The Mediating Role of Pain Catastrophizing and Anxiety

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Abstract: This study examined the relations between attachment styles and pain severity/depression in adolescents. Analyses examined whether anxiety and the 3 dimensions of pain catastrophizing mediated the associations between attachment styles, pain severity and depression. A total of 382 high-school students completed questionnaires assessing attachment styles, catastrophizing, depression, anxiety and, for those who reported pain during the last month, pain severity. Results revealed that secure attachment was associated with lower levels of pain severity, depression, pain catastrophizing and anxiety. Preoccupied and fearful attachment styles were associated with heightened pain severity, depression, pain catastrophizing and anxiety. Dismissing attachment style was only associated with high levels of depression and anxiety. Regression analyses revealed that anxiety and the helplessness dimension of pain catastrophizing mediated the relations between secure, preoccupied and fearful attachment styles and pain severity. Moreover, anxiety and the rumination dimension of pain catastrophizing mediated the relation between secure, preoccupied and fearful attachment styles and depression. These findings suggest that anxiety, pain catastrophizing and attachment styles are related processes but nevertheless make independent contributions to the prediction of pain severity and depression. In addition, these findings suggest that attachment styles and cognitive-affective factors might increase the risk of problematic outcomes in adolescents with pain conditions. Theoretical and clinical implications of these results are discussed.

Perspective: The results of this study revealed that anxiety and the helplessness dimension of pain catastrophizing mediated the relation between attachment and pain severity whereas anxiety and rumination mediated the relation between attachment and depression. Attachment style and cognitive-affective factors might increase vulnerability for problematic pain outcomes in adolescents.

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Key words: Pain catastrophizing, attachment styles, adolescents, pain, emotional distress.

Adolescence is characterized by major changes and is a critical period for the development of identity and personality. However, health-related stresses experienced by adolescents can potentially lead to various physical and mental health conditions.[40] For instance, approximately 20-25% of adolescents experience recurrent or chronic pain.[36,41,53] Persistent pain conditions in adolescents have been associated with heightened anxiety and depression.[12,13,31,43,88]

It has been argued that attachment theory may have particular relevance for understanding how adolescents deal with health-related stresses.[1] According to Bowlby,[7] children develop specific attachment styles as a function of the nature of their interactions with caregivers. In turn, attachment styles influence emotional regulation as well as the tendency to seek support when exposed to a threat situation. Bartholomew and Horowitz[6] have described 4 distinct attachment styles: 1) secure, 2) preoccupied, 3) fearful and 4) dismissing. Securely attached adolescents report high self-esteem and a positive perception of others. When exposed to a stressful situation, these individuals show high self-efficacy but are willing to solicit support when needed. Adolescents with a preoccupied attachment are characterized by low self-esteem and high fear of abandonment, yet retain a positive perception of others. Adolescents with a fearful attachment show low self-esteem, report high

fear of intimacy and low trust in others. Finally, adolescents with a dismissing attachment show a high self-esteem, a negative perception of others and appear self-reliant under stress conditions.[6]

In adults and adolescents, there is evidence to suggest that attachment styles are a significant predictor of physical and emotional distress.[16,18,29,30,68,71,89] In adults, there are findings suggesting that attachment styles are associated with chronic pain, anxiety and depression.[15,16,54,58] The relation between attachment styles and pain severity/depression has yet to be studied in adolescents. Similarly, the processes by which attachment styles impact on pain severity and depression remain unknown.

Recently, Meredith et al.[56] has put forward the "Attachment-Diathesis Model of Chronic Pain" suggesting that the relation between attachment and pain-related outcomes is mediated by appraisal-related variables such as perception of self, perception of social support and appraisal of pain. Furthermore, emotional states such as anxiety might also mediate the relation between attachment and pain-related outcomes. According to this model, attachment may impact directly on pain-related outcomes or activate cognitive processes and emotional reactions, which in turn will impact on pain-related outcomes. According to the "Attachment-Diathesis Model of Chronic Pain", catastrophic appraisals of pain and anxiety might mediate the relation between attachment and pain severity/depression.

Sullivan et al.[78] defined pain catastrophizing as an "exaggerated negative mental set brought to bear during actual or anticipated pain experience". Pain catastrophizing is characterized by 3 inter-related dimensions, namely rumination, magnification and helplessness.[78,79] In adults, many studies have shown that pain catastrophizing is a robust predictor of heightened pain severity, disability and depression.[9,77,78] Although few studies have examined the impact of pain catastrophizing on painful experiences in adolescents, recent investigations have revealed that pain catastrophizing is also an important risk factor for adverse pain outcomes in this population.[19,61] Moreover, recent studies conducted with adults reveal that individuals with insecure attachment patterns report heightened pain catastrophizing, and physical and emotional distress.[15,55,58]

There is also a basis for proposing that anxiety might mediate the relation between attachment and pain severity/depression. Indeed, evidence suggests that individuals with high anxiety frequently report heightened catastrophic thinking, pain severity and depression.[23,27,34,50,84] As proposed by Bowlby,[7,8] anxiety can arise from attachment insecurity developed in early relationships with caregivers. Mikulincer and Shaver[59,60] proposed that anxiety could be the vehicle through which individuals mobilize efforts to attain proximity to attachment figures or to maximize distance from others.[59,60]

In brief, emerging evidence from the literature suggests that attachment is associated with pain severity and depression and that catastrophizing and anxiety might play a mediating role in the relation between attachment and pain severity/depression. The current study was designed to examine the relation between attachment and pain severity/depression in adolescents and to explore the mechanisms linking attachment styles to pain severity and depression. The following predictions were made: 1) attachment styles will be associated with pain severity and depression, 2) pain catastrophizing and anxiety will be associated with pain severity and depression, 3) pain catastrophizing and anxiety will mediate the relations between attachment styles and pain severity/depression.

Material and Methods

Participants

Three hundred and eighty-two participants (223 females and 159 males) were recruited in a francophone high school in Montreal (Quebec, Canada). The mean age of the sample was 14.43 years (SD = 1.34) with a range of 12-17 years. Students were from classes of grades 8 to 12.

Instruments

Sociodemographic questionnaire

To determine the characteristics of the sample, a short sociodemographic questionnaire was developed. Participants were asked to indicate their age, sex and grade.

Pain catastrophizing

The "Pain Catastrophizing Scale for Francophone Adolescents"[83] (PCS-Ado) was used to assess catastrophic thinking related to pain. Individuals were asked to indicate the frequency with which they experience each of 13 pain-related thoughts or feelings on a 5-point scale with the endpoints 0 (never) and 4 (always). Three dimensions are measured by the PCS-Ado: 1) rumination (e.g. "I worry all the time about whether the pain will end."), 2) magnification (e.g."I wonder whether something serious may happen.") and 3) helplessness (e.g. "I feel I can't stand it anymore."). In Tremblay et al.'s study[83], the following Cronbach's alphas were obtained (Total scale: α = .85, rumination: α = .72, magnification: α = .66, helplessness: α = .74). Similar results were obtained in the current study (Cronbach's alphas: total scale: α = .88, rumination: α = .68, magnification: α = .74, helplessness: α = .80).

Anxiety

The severity of symptoms of anxiety was assessed with the Trait scale of the French version of the "State-Trait Anxiety Inventory" (STAI).[32,75] For each of the 20 items included in the Trait scale, respondents were asked to choose a number between 1 (almost never) and 4 (almost always), to indicate how frequently they experience the cognition or feeling described in the item content. Samples items include "I am a steady person" and "I lack self-confidence". In the current study, the

Cronbach's alpha was .87, which is similar to previous validation of the French version of the STAIT.[32,75]

Depression

The French version of the "Children's Depression Inventory" (CDI)[44] was used to assess the presence and severity of symptoms of depression. This questionnaire was developed to measure depressive symptoms in children aged between 7 and 17 years and includes 27 items assessing the following 5 dimensions: 1) negative mood (6 items e.g. "I am sad all the time"), 2) interpersonal problems (4 items e.g. "I never do what I am told"), 3) feelings of inadequacy (4 items e.g. "I can never be as good as other kids"), 4) anhedonia (8 items e.g. "Nothing is fun at all") and 5) low self-esteem (5 items e.g. "Nothing will ever work out for me"). For each question, adolescents choose 1 of 3 response options to indicate how they have been feeling for the last 2 weeks. For the purpose of this study, only the total score was used. In this study, the Cronbach's alpha for the total score was .87, which was similar to results from the original validation.[44]

Characteristics of Pain

A questionnaire was developed for the purposes of this study to assess the frequency and intensity of pain symptoms experienced by adolescents. This questionnaire was based on items of the "Pain Experience Interview."[53] For 10 of the most frequent types of pain, adolescents were asked to indicate how many times they had experienced each type of pain during the last month. For each pain symptom that was experienced during the past month, adolescents rated their pain severity on a 11-point scale with the endpoints 0 (no pain) and 10 (worst pain). Pain indices for each of the 10 types of pain were derived by multiplying pain severity by pain frequency.[64] For each adolescent, the pain index with the highest score was retained as the measure of pain severity. The number of participants reporting each type of pain is shown in Table 1.

Attachment style

The "Adolescent Relationship Scale Questionnaire"[69] was used to assess attachment style. A back translation procedure was used to translate the English version to French.[86] In this 18-item questionnaire, individuals were asked to indicate on a scale from 1 (this fully represents me) to 5 (this does not represent me at all) to what extent they think or feel as mentioned in the item. For each participant, a mean score was computed for secure (5 items e.g. "I find it easy to get emotionally close to others'), preoccupied (4 items e.g. "I want to be completely emotionally close with others"), fearful (4 items e.g. "I worry that I will be hurt if I become too close to others") and dismissing (5 items e.g. "It is very important to me to feel independent"). Sharfe and Eldredge[70] reported the following alpha coefficients in a sample of adolescents and young adults (secure: α = .70, preoccupied: α = .75, fearful: α = .77, dismissing: α = .45). These values are higher to those obtained in the current study

(secure: α = .45, preoccupied: α = .48, fearful: α = .69, dismissing: α = .55). Although the alphas were modest in size, observed relations between attachment styles and outcomes variables were similar in pattern and magnitude to those reported in previous research.[14,49,69,76] Issues related to the low internal consistency of measures of attachment are addressed in more depth in the discussion.

Procedure

The study procedures were approved by the Research Ethics Board of University of Montreal. A presentation was made to approximately 550 students enrolled in grades 8 to 12 describing the procedures of the study. A document briefly describing the study and a consent form were given to the students. In addition, students were asked to give a copy of the document describing the study and a consent form to their parents. Parental consent was a condition of participation. Two weeks after the first visit, students who were interested in participating in the study and had provided personal and parental consent were invited to complete the questionnaires. During questionnaire completion, the researcher remained in the classroom and was available to answer participants' questions. Following the administration of questionnaires, general information was provided about pain severity and depression in adolescence, and participants were informed that the study was designed to examine the psychological and relational factors related to heightened pain severity and emotional distress. When data collection was completed, a summary of the hypotheses and main results was sent to participants.

Approach to data analysis

All statistical analyses were conducted with the Statistical Package for the Social Sciences (SPSS V. 16.0 for Windows; SPSS, Inc, Chicago, IL). The Kolmogorov-Smirnov test was used to determine whether the data deviated from the normal distribution. Results revealed a positively skewed distribution for pain severity, fearful and dismissing attachments, anxiety, depression and pain catastrophizing dimensions and a negatively skewed distribution for age and secure attachment. To address these deviations, distributions were logarithmically transformed. The pattern of findings using transformed distributions was almost identical to the pattern obtained on the non-transformed variables. Thus, the non-transformed results are presented. Where a discrepancy in results was obtained as a result of transformation, both the non-transformed and transformed results are presented.

Descriptive analyses were conducted and Student's t-tests were performed to explore sex differences on each measure. Pearson correlations were calculated between the variables and hierarchical multiple regressions were performed to explore the relations between attachment styles, pain severity and depression. When the relations between attachment style and pain severity/depression were significant, mediation analyses were conducted to investigate whether the 3 dimensions

Table 1. Number of Participants Reporting Each Subtype of Pain

Types of pain	Never	1-2 times in the last month	3-4 times in the last month	5-6 times in the last month	7 and + in the last month	Missing	Total
Back pain	69	185	67	26	34	1	382
Arms/legs	108	151	71	30	21	1	382
Headache	70	162	73	38	38	1	382
Muscular	71	147	91	32	40	1	382
Abdominal	78	167	71	36	29	1	382
Bones	315	49	10	2	5	1	382
Knees	216	103	22	20	19	2	382
Joints	146	140	54	19	21	2	382
Ears	287	70	11	4	9	1	382
Teeth	197	127	32	10	14	2	382

of pain catastrophizing and anxiety mediated the relations between attachment, pain severity and depression. Finally, Sobel's tests[74] were performed to determine the statistical significance of the hypothetical mediation.

Results

Descriptive analyses

Descriptive data for each measure are presented in Table 2. Sex differences were examined using independent samples t-tests. Results showed that females reported greater pain severity (t (379) = 4.86, $P < .001$), anxiety (t (379) = 4.69, $P < .001$), pain catastrophizing (t (379) = 5.22, $P < .001$) and depression (t (379) = 2.23, $P = .027$) than males. In addition, females reported higher scores on the rumination (t (379) = 4.51, $P < .001$), magnification (t (379) = 3.27, $P = .001$) and helplessness (t (379) = 5.30, $P < .001$) subscales of the PCS-Ado. Males scored higher on dismissing attachment style than females (t (379) = -2.71, $P = .007$).

Correlations among variables

As shown in Table 3, secure attachment was negatively correlated with anxiety, pain severity and depression and with the 3 dimensions of pain catastrophizing. Preoccupied attachment was positively correlated with anxiety, depression and pain severity and with the 3 dimensions of pain catastrophizing. Fearful attachment style was positively correlated with depression, anxiety, pain severity, as well as with magnification and helplessness. Finally, dismissing attachment was significantly correlated with anxiety and depression but not with the 3 dimensions of pain catastrophizing or pain severity.

Regressions and mediational analyses

Hierarchical multiple regressions were performed to explore whether anxiety and pain catastrophizing mediated the relation between attachment style and pain severity/depression. In each regression equation, age and gender were entered as covariates. To examine whether the relations between attachment and pain severity/depression are mediated by the 3 dimensions of pain catastrophizing and anxiety, 4 conditions must be met: a) attachment styles must be significantly associated with pain catastrophizing and anxiety, b) attachment

styles must be significantly associated with pain severity/depression, c) pain catastrophizing and anxiety must be significantly associated with pain severity/depression and d) the relation between attachment styles and pain severity/depression must significantly decrease after controlling for the effect of pain catastrophizing and anxiety.[5] Secure, preoccupied and fearful attachment styles were significantly correlated with pain severity, depression, pain catastrophizing and anxiety, thus meeting pre-requisite conditions for testing mediation. Dismissing attachment was not used in the subsequent analyses because it did not meet pre-requisite conditions.

The first regression analysis examined whether secure attachment predicted pain severity. As shown in Table 4, results showed that higher scores on secure attachment predicted lower scores on pain severity (R = .294, F (3, 378) = 11.96, $P < .001$). A second regression analysis examined whether the relation between secure attachment and pain severity was mediated by the 3 dimensions of pain catastrophizing and anxiety. As shown in Table 4, results showed that, when all variables were entered in the regression equation, the model predicted 22% of the variance (R = .468, F (7, 374) = 15.01,

Table 2. Sex Differences in the Scores on the Outcome Measures: Results of Independent Samples T-Tests

Variables	Males M (SD) N = 159	Females M (SD) N = 223	Total M (SD) N = 382
PCS-Ado total	18.44 (8.03) **	23.11 (8.97) **	21.19 (8.88)**
Rumination	8.03 (2.95) **	9.39 (2.88) **	8.38 (2.99) **
Magnification	4.04 (2.56) **	4.98 (2.89) **	4.59 (2.79) **
Helplessness	6.38 (3.90) **	8.74 (4.54) **	7.76 (4.43) **
A-RSQ			
Secure	3.35 (.92)	3.25 (.86)	3.29 (.05)
Preoccupied	2.50 (1.05)	2.56 (.99)	2.53 (.05)
Fearful	1.68 (1.10)	1.72 (1.01)	1.70 (.05)
Dismissing	2.30 (.91) **	2.06 (.86) **	2.16 (.05) **
STAIT	36.14 (8.72) **	40.56 (9.31) **	38.75 (9.32) **
CDI	8.52 (5.98) **	10.04 (6.98) **	9.41 (6.61)**
Pain	14.54 (11.26) **	20.20 (11.16) **	17.90 (11.56)**

Abbreviations: PCS-Ado, Pain Catastrophizing Scale for Francophone Adolescents, A-RSQ: Adolescent Relationship Scale Questionnaire, CDI: Children's Depression Inventory, STAIT: Trait scale of the State-Trait Anxiety Inventory, Pain: Total pain index (Frequency × Intensity).
**Sex difference was significant with $P < .01$.

Table 3. Correlations Between Attachment Style, Pain and Emotional Distress

VARIABLES	PCS-ADO	RUM	MAGN	HELPLESS	SECURE	PREOCCUPED	FEARFUL	DISMISSING	STAIT	CDI	PAIN
PCS-Ado	1.00										
Rumination	.85*	1.00									
Magnification	.81*	.55*	1.00								
Helplessness	.92*	.68*	.62*	1.00							
Secure	−.28*	−.19*	−.22*	−.28*	1.00						
Preoccupied	.21*	.17*	.17*	.19*	−.37*	1.00					
Fearful	.16*	.09	.20*	.14*	−.42*	.28*	1.00				
Dismissing	−.05	−.05	-.03	−.05	−.19*	−.15*	.44*	1.00			
STAIT	.54*	.39*	.45*	.54*	−.51*	.41*	.45*	.15*	1.00		
CDI	.29*	.17*	.24*	.31*	−.42*	.28*	.38*	.22*	.71*	1.00	
Pain	.29*	.20*	.19*	.32*	−.18*	.22*	.14*	-.01	.43*	.30*	1.00

Abbreviations: PCS-Ado, Pain Catastrophizing Scale for Francophone Adolescents, CDI: Children's Depression Inventory, STAIT: Trait scale of the State-Trait Anxiety Inventory, Pain: Total pain index (Frequency × Intensity).
N = 382; *P < .01.

$P < .001$). Examination of beta weights for the final regression equation revealed that only gender, anxiety and the helplessness subscale of the PCS-Ado contributed unique variance to the prediction of pain severity. In addition, the relation between secure attachment and pain severity was no longer significant when controlling for anxiety and the PCS subscales. When Sobel's tests were conducted with anxiety and helplessness separately, results showed that the relation between secure attachment and pain severity was significantly mediated by helplessness (Sobel's test = 3.97, $P < .001$) and anxiety (Sobel's test = 6.79, $P < .001$).

For depression, results showed that higher scores on secure attachment predicted lower scores on depression (R = .427, F (3, 378) = 28.07, $P < .001$). Furthermore, results showed that, when all variables were entered in the regression equation, the model predicted 52% of the variance (R = .721, F (7, 374) = 57.89, $P < .001$). Examination of beta weights for the final regression equation revealed that only anxiety and the rumination subscale of the PCS-Ado contributed unique variance to the prediction of depression. Furthermore, the relation between secure attachment and depression was no longer significant when controlling for anxiety and all 3 dimensions of pain catastrophizing. When Sobel's tests were performed with anxiety and rumination separately, results showed that the relation between secure attachment and depression was significantly mediated by rumination (Sobel's test = 2.37, $P = .01$) and anxiety (Sobel's test = 9.88, $P < .001$).

A similar pattern emerged in mediational analyses for preoccupied attachment. As shown in Table 5, higher scores on the preoccupied attachment scale predicted higher pain severity (R = .317, F (3, 378) = 14.06,

Table 4. The Role of Pain Catastrophizing in the Mediation of the Relation Between Secure Attachment and Pain/Depression

	PAIN				DEPRESSION			
MODELS	β	R² CHANGE	F CHANGE	P	β	R² CHANGE	F CHANGE	P
Regression 1: Secure attachment and outcome measures								
Step 1								
Age	−.09	.06	11.44 (2, 379)	.000	.03	.01	2.70 (2, 379)	.068
Gender	−.23**				−.09			
Step 2								
Secure attachment	−.17**	.03	12.34 (1, 378)	.000	−.41**	.17	77.69 (1, 378)	.000
Regression 2: The mediating role of pain catastrophizing and anxiety								
Step 1					.03	.01	2.70 (2, 379)	.068
Age	−.09	.06	11.44 (2, 379)	.000	.03			
Gender	−.13**							
Step 2								
Rumination	−.05	.16	19.37 (4, 375)	.000	−.10*	.50	97.19 (4, 375)	.000
Magnification	−.09				−.04			
Helplessness	.18*				−.01			
Anxiety	.38**				.74**			
Step 3								
Secure attachment	.04	.00	.47 (1, 374)	.495	-.08	.00	3.12 (1, 374)	.074

NOTE. Beta weights are from the final regression equation.
N = 382; *P < .05;**P < .01.

Table 5. The Role of Pain Catastrophizing in the Mediation of the Relation Between Preoccupied Attachment and Pain/Depression

	PAIN				DEPRESSION			
MODELS	β	R^2 CHANGE	F CHANGE	P	β	R^2 CHANGE	F CHANGE	P
Regression 1: Preoccupied attachment and outcome measures								
Step 1								
Age	−.08	.06	11.44 (2, 379)	.000	.04	.01	2.70 (2, 379)	.068
Gender	−.23**				−.10			
Step 2								
Preoccupied	.21**	04	18.23 (1, 378)	.000	.27**	.07	30.35 (1, 378)	.000
Regression 2: The mediating role of pain catastrophizing and anxiety								
Step 1								
Age	−.09	.06	11.44 (2, 379)	.000	.03	.01	2.70 (2, 379)	.068
Gender	−.14**				.04			
Step 2								
Rumination	−.05	.16	19.37 (4, 375)	.000	−.10*	.50	97.19 (4, 375)	.000
Magnification	−.09				−.04			
Helplessness	.18*				−.01			
Anxiety	.33**				.78**			
Step 3								
Preoccupied	.07	.00	1.75 (1, 374)	.187	−.02	.00	.17 (1, 374)	.681

NOTE. Beta weights are from the final regression equation.
N = 382; *$P < .05$;**$P < .01$.

$P < .001$). In addition, when all variables were entered in the regression equation, results showed that the model explained 22% of the variance (R = .471, F (7, 374) = 15.25, $P < .001$). Examination of the beta weights for the final regression equation showed that only the helplessness subscale of the PCS-Ado and anxiety emerged as unique predictors of pain severity. Furthermore, the relation between preoccupied attachment and pain severity was no longer significant after controlling for anxiety and the PCS-Ado subscales. Sobel's tests showed that the relation between secure attachment and pain severity was significantly mediated by helplessness (Sobel's test = 3.10, $P < .001$) and anxiety (Sobel's test = 6.07, $P < .001$).

For depression, results showed that higher scores on the preoccupied attachment scale predicted higher scores on the depression scale (R = .296, F (3, 378) = 12.06, $P < .001$). When all variables were entered, the regression model explained 52% of the variance (R = .718, F (7, 374) = 56.99, $P < .001$). Examination of the beta weights for the final regression equation showed that the rumination dimension of pain catastrophizing and anxiety contributed unique variance to the prediction of depression. Furthermore, the relation between preoccupied attachment and depression was no longer significant when all variables were simultaneously entered in the regression model. Sobel's tests showed that the relation between preoccupied attachment and depression was significantly mediated by rumination (Sobel's test = 2.24, $P = .02$) and anxiety (Sobel's test = 7.98, $P < .001$).

As shown in Table 6, higher scores on the fearful attachment scale predicted higher pain severity (R = .280, F (3, 378) = 10.71, $P = .003$). When all variables were entered in the regression equation, the regression model explained 22% of the variance (R = .468, F (7, 374) = 14.96, $P < .001$). Examination of the beta weights for the final regression equation showed that gender, helplessness and anxiety made unique contributions to the prediction of pain severity. In addition, the relation between fearful attachment and pain severity was no longer significant when all variables were entered in the regression model. Sobel's tests showed that the relation between fearful attachment and pain severity was significantly mediated by helplessness (Sobel's test = 2.47, $P = .01$) and anxiety (Sobel's test = 6.45, $P < .001$). However, when regression was performed with the transformed values, the relation between fearful attachment and pain severity was marginally significant (R^2 = .082, F (3, 355) = 10.61, $P = .051$). When all variables were entered in the regression equation, the model explained 22% of the variance (R = .466, F (7, 331) = 13.12, $P < .001$). Results revealed that the relation between fearful attachment and pain severity was no longer significant when all variables were entered in the equation. Only anxiety emerged as a significant mediator (Sobel's test = 5.48 $P < .001$).

Finally, results showed that higher scores on the fearful attachment scale predicted higher scores on the depression scale (R = .407, F (3, 378) = 23.66, $P < .001$). When all variables were entered in the regression equation, the model explained 52% of the variance (R = .721, F (7, 374) = 57.76, $P < .001$). Examination of the beta weights for the final regression showed that rumination and anxiety made unique contributions to the prediction of depression. In addition, when all the variables were entered in the regression equation, the relation between fearful attachment and depression was no longer significant. Sobel's tests showed that rumination did not significantly mediate the relation between fearful

Table 6. The Role of Pain Catastrophizing in the Mediation of the Relation Between Fearful Attachment and Pain/Depression

Models	Pain				Depression			
	β	R^2 Change	F Change	P	β	R^2 Change	F Change	P
Regression 1: Fearful attachment and outcome measures								
Step 1								
Age	−.10*	.06	11.33 (2, 379)	.000	−.01	.01	2.70 (2, 379)	.068
Gender	−.22**				−.11*			
Step 2								
Fearful attachment	.15**	.02	8.78 (1, 378)	.003	.38**	.14	64.65 (1, 378)	.000
Regression 2: The mediating role of pain catastrophizing and anxiety								
Step 1								
Age	−.09	.06	11.44 (2, 379)	.000	.02	.01	2.70 (2, 379)	.068
Gender	−.13**				.03			
Step 2								
Rumination	−.05	.16	19.37 (4, 375)	.000	−.10*	.50	97.19(4, 375)	.000
Magnification	−.09				−.05			
Helplessness	.17*				.00			
Anxiety	.37**				.74**			
Step 3								
Fearful attachment	−.02	.00	.16 (1, 374)	.694	.07	.00	2.77 (1, 374)	.096

NOTE. Beta weights are from the final regression equation.
N = 382; *P < .05;**P < .01.

attachment and depression (Sobel's test = 1.59, P = .11) but the relation between fearful attachment and depression was significantly mediated by anxiety (Sobel's test = 8.90, P < .001).

Discussion

The main objectives of the current study were to investigate whether attachment styles were associated with pain severity and depression in adolescents and to examine whether anxiety and pain catastrophizing mediated the relation between attachment, pain severity and depression. Consistent with previous research conducted with adults, secure attachment was associated with low levels of pain catastrophizing, anxiety, pain severity and depression whereas preoccupied and fearful attachment styles were associated with heightened pain catastrophizing, anxiety, pain severity and depression.[16,17,28,54,66] In the present study, dismissing attachment was associated only with anxiety and depression. Furthermore, consistent with previous research, males obtained higher scores on dismissing attachment than females whereas females reported higher levels of anxiety, pain catastrophizing, depression and pain severity than males.[72,78,85]

As predicted, regression analyses revealed that pain catastrophizing and anxiety mediated the relation between attachment styles (excluding avoidant) and both pain severity and depression. These results are consistent with the predictions of the "Attachment-Diathesis Model of Chronic Pain."[56] The model proposes that attachment may be linked to physical and psychological characteristics of pain through emotional and cognitive variables such as appraisals of pain, self-evaluations, perception of others and emotional reactions. In the present

study, pain catastrophizing was considered as a pain appraisal.[78] The results of the present study suggest that specific dimensions of pain catastrophizing and anxiety mediated the relation between attachment and pain severity/depression.

For pain severity, analyses revealed that anxiety and the helplessness dimension of pain catastrophizing mediated the relation between attachment styles (secure, preoccupied and fearful) and pain severity. These results are consistent with previous studies showing that the helplessness dimension of pain catastrophizing is a significant predictor of pain severity.[63,80,81] Moreover, these results are consistent with previous studies suggesting that insecure attachment might contribute to helplessness-related constructs such as low self-efficacy, external locus of control and passive coping strategies.[3,28,55] Helplessness-related constructs have also been shown to be significant determinants of somatic symptoms and of pain outcomes in adolescents.[4,11]

For depression, results of the current study revealed that anxiety and the rumination dimension of pain catastrophizing mediated the relation between the 3 attachment styles and depressive symptoms. These results are consistent with previous investigations revealing that ruminative thinking is a risk factor for the development and maintenance of depressive symptoms.[21,22,42,45,47,52] Indeed, it has been previously shown that that people at risk for depression are more likely to experience escalations from mild negative emotional states to dysphoria due to increased accessibility of negative information (e.g. negative perception of self) and processing patterns characterized by rumination.[45]

Recently, numerous investigations have addressed the physiological mechanisms by which catastrophic thinking might influence pain severity and depression. High

catastrophizing has been associated with lower pain threshold,[25] lower pain tolerance[24,26] and greater temporal summation of pain.[26] In addition, individuals with high catastrophizing show enhanced activity in brain regions involved in anticipation and attention toward pain[87] as well as in brain regions (e.g. anterior cingulate cortex) involved in the affective processing of pain.[33,73] It has been suggested that catastrophizing might interfere with processes involved in descending inhibitory control of pain contributing to a generalized hyperalgesic state.[26,90]

From a cognitive perspective, the different dimensions of pain catastrophizing have previously been discussed in relation to Lazarus and Folkman's transactional model of stress and coping. According to Lazarus & Folkman,[46] primary appraisals (i.e., judgments about the threat value of a stimulus) are related to secondary appraisals (i.e., judgments about coping options and their possible effectiveness) and influence which coping responses will be attempted. As suggested by Sullivan et al.[78] magnification and rumination may be related to primary appraisal processes in which individuals may focus on and exaggerate the threat value of a painful stimulus whereas helplessness may be related to secondary appraisal processes in which individuals negatively evaluate their ability to deal effectively with painful stimuli. As suggested by Meredith et al[56] certain attachment styles might impact negatively on individuals' appraisals of stressful or health-related situations, as well as on their efforts to cope with these situations.

Finally, results of the current study are consistent with previous studies showing that individuals with preoccupied and fearful attachment experience heightened anxiety[48,54,57] and that anxiety is associated with greater pain severity and depression.[10,12,61] In addition, even though the correlation between pain catastrophizing and anxiety is high, the results of the present study suggest that anxiety contributed significant unique variance to the prediction of pain severity and depression even when controlling for rumination, magnification and helplessness. It is possible that anxiety might emerge as a consequence of the stress viewing one's relationships with insecurity, fear of being hurt or being abandoned.[59,60] The persistence of anxiety might promote the maintenance of rumination and further compound adverse outcomes by "depleting" the individuals' adaptational resources. Indeed, as proposed by the resource depletion model of adverse health outcomes,[38] exposure to chronic stresses will eventually lead to a reduction of resources that might be deployed to cope or adapt to ongoing demands. It is possible that a similar process might operate with the chronic stress of relational dysruption or loss, or that anxiety might be 1 of the "stress factors" contributing to resources depletion. This line of reasoning suggests that stress-related effects such as anxiety might impact on pain severity and depression through mechanisms distinct from cognition.

From a clinical perspective, the results of the present study suggest that interventions targeting catastrophic thinking and anxiety in adolescents might yield benefi-cial outcomes. For instance, Thorn et al.[82] described cognitive-behavioural techniques aimed at reducing catastrophic thinking and anxiety in adults. Similar approaches might be useful for adolescents who experience troubling pain symptoms. Interventions designed to more directly target attachment styles might also be worth considering.

To date, several intervention programs have been specifically developed to address attachment problems in young children.[39,51] It is not clear to what degree such approaches would be applicable to the attachment difficulties of adolescents with recurrent or chronic pain.[20] However, experiential family therapy might help adolescents to develop communication skills[62,67] whereas cognitive-behavioural family therapy might be useful in equipping adolescents and their family with resources that might positively impact on the quality of the relationships between members of the family.[62,65]

A number of limitations need to be considered in interpretation of the present findings. First, as previously discussed, the internal consistency of the attachment measure was lower than desirable. In early research in this area, attachment style was assessed through behavioral tests or interview, yielding categorical classification of attachment styles. The methods of assessment and the classification schemes varied across investigators.[6] Self-reported measures were later developed to facilitate research in this area. The first measures were single-item measures where internal consistency could not be assessed.[6,70] These have since evolved into dimensional multi-item measures but internal consistency remains low.[35,91] Griffin and Bartholomew[35] have suggested that the internal consistency of the RSQ might be low as a result of 2 underlying dimensions (models of self and of others) being combined to create the 4 RSQ dimensional attachment scores. In addition, the reverse scoring of some items within attachment subscales might impact negatively on internal consistency, particularly with younger participants.[35] Despite the low internal consistency of the French version of the RSQ used in this study, the pattern of relations among attachment styles, negative mood states, catastrophizing and pain replicates what has been previously reported in the literature.[35,69] In more recent research, measures of attachment have been developed to address attachments to specific individuals in the respondent's life, as opposed to general measures attachment such as the RSQ.[2,37] It is possible that a measure of specific attachments (e.g. friends, parents) might yield higher internal consistency coefficients than were observed in the present study.

Another limitation that must be considered is that the study was conducted with a healthy student population and the results may not be generalizable to children and adolescents with a clinical pain condition. In addition, approximately 30% of the students elected not to participate in the study. Given that the characteristics of those who refused to participate in the study were unknown, results obtained with the final sample may not be generalizable to all adolescents. Furthermore, a cross-sectional design was used which limits inferences of causality.

Finally, although there was a theoretical basis for proposing a causal link between anxiety and depression, it is important to consider that the strong correlation between scores on anxiety and depression measures might be the result of item overlap between both measures.

In summary, results of the current study are consistent with previous research showing a relation between attachment styles and pain severity/depression. The findings of the present study extend previous research in showing that relations between attachment and pain severity/depression, that had previously only been demonstrated in adults, are apparent in adolescents as well. Furthermore, the results of the present study suggest that catastrophizing and anxiety play a role in mediating the relation between attachment and pain severity/depression. Challenges for future research include the replication of this study with more internally

consistent measures of attachment. The findings suggest that intervention approaches that target attachment style might complement current cognitive-behavioral interventions for the management of pain in adolescents.

Acknowledgement

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