

Can parental pain catastrophizing influence the relationship between dental caries and pain in early childhood?

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Objective: Knowledge on the parents' catastrophizing of the children's dental pain is lacking. This study aimed to verify whether parental pain catastrophizing influences the relationship between caries and dental pain in early childhood and if the child's age interacts with this relationship. **Study design:** A cross-sectional study was carried out with 83 dyads of children and their parents/primary caregivers. The parents answered the Brazilian version of the Pain Catastrophizing Scale-Parents and the Dental Discomfort Questionnaire. The children were examined to measure their caries experience. Correlations, simple mediation, and conditional process analyses were performed. **Results:** The research participants were mostly male children (50.6%) with a mean age of 38 months (Q1 33.0, Q3 48.0). Most of the parents were mothers (n = 73; 88.0%) and had catastrophic thoughts (80.7%). Perceived dental pain in the child was positively correlated with the child's caries experience and parental pain catastrophizing. The parents' catastrophizing did not mediate the relationship between the caries experience and the pain intensity (a * b = 0.05; the lowest level of the confidence interval: -0.01; upper level of the confidence interval: 0.14). The child's age did not moderate the direct or indirect effect of the caries experience on the pain intensity of the children. **Conclusion:** In early childhood, parental catastrophizing of the children's pain and children's age does not influence the direct relationship between children's caries experience reported by the dentist and children's dental pain reported by parents.

Keywords: Dental caries, Toothache, Catastrophizing, Child, Preschool, Pain assessment

INTRODUCTION

Pain and related factors assessment are mandatory in health care; however, it is challenging when a self-report approach is not possible, as occurs when studying early childhood conditions. There are three main ways to assess pain intensity in children: physiological, behavioral, and self-report¹. Although self-report measures are preferable for obtaining information about childhood pain, they are limited to children who can communicate and understand what they feel¹. The parents' report about their child's pain can be a reliable measure in diagnosing pain in early childhood^{1,2}; still, responses can be influenced by the adults' personality and emotional characteristics³ such as pain catastrophizing⁴.

Studies on how parental pain catastrophizing can influence the pain responses of their children have been developed. Pain catastrophizing refers to a set of negative and exaggerated cognitions and emotions through a condition of actual or future pain⁵. Parents who catastrophize about their children's pain may experience emotional reactions⁶, showing to be more anxious and distressed than those who do not have catastrophic thoughts about their children's pain⁷. This situa-

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tion can lead to adverse effects in children, such as increased pain intensity^{8,9}, pain catastrophizing by the child^{10,11}, and increased pain behavior (perceived by parents)¹².

Pain in the mouth (mainly dental) is a condition that affects approximately one in seven young children globally and negatively impacts their wellbeing^{13,14}. Parents report dental pain in their young children by observing their daily activities (e.g., negative behaviors when eating or sleeping)¹⁵. In early childhood, dental caries is reported as the leading cause of toothache^{16–18}. When the child's dental pain is not managed, psychological, physical, and social damage can be generated, having a substantial negative impact on these children's and family's daily lives^{19–21}.

Adults describe their toothaches as the worst feelings ever felt²², being more intense than earaches or headaches and comparable to backaches²³. When mothers perceive pain in their children, they remember their past suffering and seek help²⁴. One study revealed that young children's toothache at night is associated with parental catastrophizing²⁵. However, whether children's pain catastrophizing by parents impacts the direct effect of children's caries experience on parental pain reports remains unclear. The present study aimed to verify if parental catastrophizing of their children's pain influences the relationship between dental caries and perceived dental pain in early childhood and, further, whether the child's age interacts with this relationship.

MATERIALS AND METHODS

Study design and participants

Participants in this cross-sectional study were 84 healthy children (2–6 years old) and one parent or primary caregiver, who were included in a clinical trial registered at ClinicalTrials.gov (NCT02447289), performed in a dental sedation center at Federal University of Goiás (Goiânia, Brazil) during the years of 2014–2016. The inclusion criteria for this trial were: healthy children without neurological or cognitive problems, born at term, and with a history of non-collaborative behavior in previous visits to the dentist. After consenting to participate in the study and authorizing their child's participation, the respondents completed questionnaires about demographic data (sex and age of the child), perception of their child's toothache, and catastrophizing of their child's pain. A pediatric dentist then examined the children, and their caries experience was evaluated. Participants who did not return or complete the questionnaires were excluded. This study was approved by the Human Research Ethics Committee of the Federal University of Goiás, following the guidelines from the National Health Council of 12 December 2012 (Resolution No. 466/2012) and Helsinki Declaration. The participants signed an informed consent form; parents granted the consent on behalf of their children.

Pain catastrophizing by parents

The Pain Catastrophizing Scale-Parents (PCS)⁷ is used to assess how much parents catastrophize their children's pain. This scale consists of 13 items that describe the parents' negative feelings and perceptions regarding their child's pain, structured in three domains: rumination, magnification, and

helplessness. For this study, the Brazilian version of the PCS-P was used²⁵. The following sentence on the questionnaire was given to parents to answer: 'For each question, circle the word or phrase that best reflects the intensity of your feelings when your child is in pain.' The response scores range from 0 (no at all) to 4 (all the time), with a maximum total score of 52 points. When the total score is equal to or greater than 30, the level of catastrophizing must be considered clinically relevant²⁶. In this study, parents who presented with those scores were classified as catastrophizers.

Dental pain intensity

The Brazilian version of the Dental Discomfort Questionnaire (DDQ-B) can identify tooth pain caused by caries in Brazilian children²⁷. It is an instrument made up of seven items, applied to the child's parents, and considered effective in differentiating the presence or absence of toothache. There are three answer options ('Never', 'Sometimes', and 'Often'), with scores ranging from 0 to 2 for each item and a total score ranging from 0 to 14. A total score equal to or greater than three means that the child may be experiencing dental pain¹⁵.

Caries experience

The decayed, missing, and filled teeth (dmft) index was used to evaluate the experience of caries in primary teeth²⁸. It can be calculated by adding the number of decayed primary teeth ('d'), with indicated extraction ('m') and restored ('f'). The children were submitted to a dental examination by a professional with experience in treating children shortly after the parents completed the questionnaires and during the initial consultation of the clinical trial. The dental exam was performed in a dental chair, under artificial light, and after dental prophylaxis.

Statistical analysis

The statistical tests were performed with the IBM SPSS Statistics for Macintosh Version 24.0 (IBM Corp., Armonk, NY, United States) with the PROCESS macro for the moderation and mediation analyses²⁹; the significance value was set to $p < 0.05$ (95% confidence intervals).

The Kolmogorov-Smirnov test was used to verify the normality of the quantitative variables and define their description as mean and standard deviation (SD) or median and quartiles one (Q1) and three (Q3), as well as the bivariate tests to test their relationships. Frequencies (n) and percentages (%) were calculated for the description of children's sex.

We ran the Spearman correlation test to calculate correlations between the variables—children's age, caries experience (dmft), pain intensity (DDQ-B)—and pain catastrophizing by parents (PCS-P). The correlation coefficients were considered weak (between 0.1 and 0.2), moderate (between 0.3 and 0.6), and strong (between 0.7 and 0.9).

To test how parental catastrophizing of their children's pain mediates the effect of caries experience on dental pain report, we used PROCESS (v. 3.4, model 4) and performed a simple mediation model with 5000 bootstrap samples and applied a confidence interval of 95%²⁹. Caries experience (dmft) was added as the predictor, dental pain intensity (DDQ-B) as the

outcome, and parental catastrophizing (PCS-P) as the mediator (Fig. 1).

We also used the PROCESS (v. 3.4, model 15) to test whether children's age interacts with the relation 'parental catastrophizing and children's dental caries and pain intensity'²⁹. A moderated mediation model (conditional process analysis) was performed with the same standards as above (5000 bootstrap samples, confidence interval of 95%) and adding the children's age as the moderator to the previous mediation model (Fig. 2).

RESULTS

Of the 84 children and their parents who participated in the original clinical trial, one dyad was excluded for not responding to the PCS-P. The descriptive data of the participants are shown in Table 1. Just over half of the children were male (50.6%), with a median age of 38.0 months (Q1 33.0, Q3 48.0), and most of the respondents were mothers ($n = 73$; 88.0%). We ran the following analysis for all respondents, as only mothers' cases did not impact the final results reported herein. As most of them were parents, we hereafter use the noun 'parents' for clarity.

The children's dmft mean was 8.5 (SD 3.9), and their parents reported a pain intensity (DDQ-B) with a median of 4.0 (Q1 3.0, Q3 8.0). Parental catastrophizing, as assessed through the PCS-P, had a mean of 36.6 (SD 9.3). Considering the cut-off point for the PCS-P, 80.7% ($n = 67$) of parents were catastrophizers about their children's pain. DDQ-B presented significant correlations with PCS-P and dmft (Table 2). These variables did not associate with children's sex (data not shown).

The results for the simple mediation model show that the direct effect of caries experience remained significant when statistically controlling for pain catastrophizing in the regression model ($c = 0.22$; $p = 0.01$). The parental pain catastrophizing was not a partial mediator for the relationship caries experience—pain intensity as the confidence interval crosses zero ($a \times b = 0.05$; lower level of the confidence interval: -0.01; upper level of the confidence interval: 0.14) (Table 3).

In the moderated mediation model, no effect was observed between age and the mediator or the outcome variables or between pain catastrophizing and age with the dental pain intensity (Table 4). Caries experience remained a predictor for the pain intensity and accounted for the total effect of the model. The model predicted that children who differed by one unit in caries experience were estimated to vary by 0.22 units in their pain intensity. These results indicate that children's age did not moderate the direct or indirect (through catastrophizing) effect of caries on pain intensity.

DISCUSSION

This study sheds light on a relevant topic for the pediatric dentistry practice. There was a direct relationship between caries experience in early childhood and the child's dental pain intensity report by parents. Although expected, this correlation was not influenced either by parental catastrophizing on their children's pain or by the children's age. Below, we interpret this result guided by the following principles: 1- dental

Table 1: Descriptive data of the participants.

Characteristics	
Children ($n = 83$)	
Sex, n (%)	
Male	42 (50.6)
Female	41 (49.4)
Age (months), median (quartiles 1–3)	38.0 (33.0–48.0)
Caries experience (dmft), mean (SD)	8.5 (3.9)
Pain intensity (DDQ-B), median (quartiles 1–3)	4.0 (3.0–8.0)
Primary caregiver ($n = 83$)	
Respondents, n (%)	
Mothers	73 (88.0)
Fathers	4 (4.8)
Grandparents	3 (3.6)
Other Relatives	3 (3.6)
Catastrophizing (PCS-P), n (%)	
No	16 (19.3)
Yes	67 (80.7)

dmft—decayed, missing, and filled index for primary teeth; *DDQ-B*—Dental Discomfort Questionnaire, Brazilian version; *PCS-P*—pain catastrophizing scale by parents; *SD*—Standard Deviation.

pain has an acute nature; 2- the children's age group was restricted to early childhood; 3- catastrophizing trait and state; 4- other dimensions of pain.

We proposed the present moderated-mediation model inspired by the study by Langer *et al.*⁶ with 8–17-year-old children with inflammatory bowel disease. In that study, parental catastrophizing was a partial mediator for the association between parental report of child pain and their protective responses towards their child's symptoms⁶. Children's older age and their chronic disease may have led to mediation⁶. In the endodontic context, adults' catastrophizing was associated with pain in interventions but not with pain reports in the first session³⁰. Dental pain is an acute pain that requires immediate access to the dental office, as home 'remedies' do not solve the problem²⁴. We could then hypothesize that parents with higher levels of catastrophic thinking did not have enough time to let their thoughts influence their perception of children's pain.

However, when the bivariate analysis was performed, a positive correlation between parents' catastrophic thoughts and their report of children's dental pain intensity was found. Overall, most parents had catastrophic thoughts about their children's pain. Nevertheless, we assessed parental pain catastrophizing as a personality trait and not a specific situational circumstance (state). A study with 8 to 12-year-old children during a cold pressor task and their parents³¹ found a significant interaction between child and parent state pain catastrophizing in predicting child symptom complaints. Another study with adolescents (10 to 18 years) and parents examined the role of their pain catastrophizing to produce pain memories after surgery. The results showed that the respondents' catastrophizing influenced the pain memory³². However, parents' catastrophizing had a more prominent role in recognizing the adolescents' pain by both children and parents³². The lack

Table 2: Correlations between children’s age, caries experience, and dental pain intensity, and pain catastrophizing by parents.

		Age	Caries experience (dmft)	Dental pain intensity (DDQ-B)
Caries experience (dmft)	rho	0.140	1	0.270
	<i>p</i>	0.215		0.015
Dental pain intensity (DDQ-B)	rho	0.060	0.270	1
	<i>p</i>	0.605	0.015	
Parental pain catastrophizing (PCS-P)	rho	0.040	0.150	0.360
	<i>p</i>	0.704	0.168	0.001

Dmft—decayed, missing, and filled index for primary teeth; DDQ-B—Dental Discomfort Questionnaire, Brazilian version; PCS-P—pain catastrophizing scale by parents.

Spearman’s correlation test; bold numbers mean significant correlations.

Table 3: Results of the simple mediation analysis investigating parental catastrophizing as a mediator between children’s caries experience and dental pain parental report.

	Normal theory test					
	Coeff.	SE	<i>t</i>	<i>p</i>	LLCI	ULCI
Effect of caries experience on pain catastrophizing (<i>a</i> path)	0.43	0.26	1.65	0.100	-0.09	0.94
Effect of pain catastrophizing on pain report (<i>b</i> path)	0.13	0.03	3.68	<0.001	0.06	0.20
Direct effect of caries experience on dental pain intensity (<i>c</i> path)	0.42	0.26	1.57	0.120	0.06	0.38
	Bootstrap results for the indirect effect					
	Effect	Boot SE	Boot LLCI	Boot ULCI		
Indirect effect of caries experience on dental pain intensity through pain catastrophizing (<i>a</i> × <i>b</i> path)	0.05	0.04	-0.01	0.14		

Coeff.: coefficient; *SE:* standard error; *LLCI:* lower level of the 95% confidence interval; *ULCI:* upper level of the 95% confidence interval.

Table 4: Moderated mediation analysis investigating children’s age as a moderator of the indirect effect of caries experience on pain intensity through pain catastrophizing.

Antecedent	Pain catastrophizing (mediator)				Consequent			
		Coeff.	SE	<i>p</i>		Coeff.	SE	<i>p</i>
Caries experience (predictor)	<i>a</i>	0.43	0.26	0.10	<i>c’</i> ₁	0.22	0.08	0.01
Pain catastrophizing (mediator)	-	-	-	-	<i>b</i> ₁	0.17	0.1	0.09
Age (moderator)	-	-	-	-	<i>b</i> ₂	0.05	0.08	0.56
Pain catastrophizing × Age	-	-	-	-	<i>c’</i> ₂	0.00	0.00	0.63
	Conditional indirect effects of caries experience on pain intensity through pain catastrophizing							
Age, months (16th, 50th and 84th percentiles)					Effect	Boot SE	Boot LLCI	Boot ULCI
30					0.06	0.04	-0.01	0.15
38					0.06	0.04	-0.01	0.14
56.68					0.05	0.04	-0.01	0.13

Coeff.: coefficient; *SE:* standard error; *LLCI:* lower level of the 95% confidence interval; *ULCI:* upper level of the 95% confidence interval.

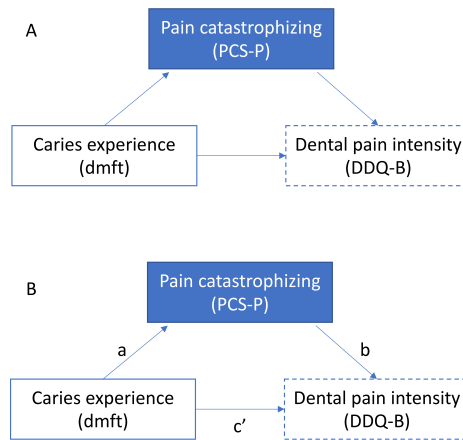


Figure 1: Diagrams of the simple mediation model. Fig. 1A: Conceptual diagram testing if parental catastrophizing of their children’s pain influences the relationship of caries and pain intensity. Fig. 1B: Statistical diagram for the same model. Abbreviations: dmft—decayed, missing, and filled index for primary teeth; DDQ-B—Dental Discomfort Questionnaire, Brazilian version; PCS-P—pain catastrophizing scale by parents.

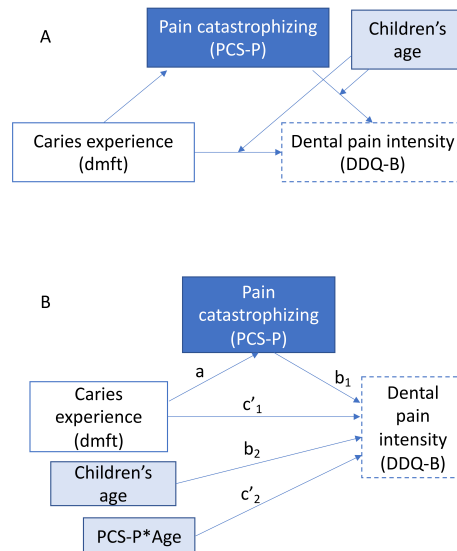


Figure 2: Diagrams of the conditional process analysis. Fig. 2A: Conceptual diagram for testing if the children’s age could indirectly influence parental catastrophizing of children’s pain and directly influence the relationship of caries and pain intensity. Fig. 2B: Statistical diagrams of the same model. Abbreviations: dmft—decayed, missing, and filled index for primary teeth; DDQ-B—Dental Discomfort Questionnaire, Brazilian version; PCS-P—pain catastrophizing scale by parents.

of evidence on the associations between young children’s and parents’ pain catastrophizing makes it challenging to compare our results.

Pre-schoolers have difficulties describing their pain, identifying why pain hurts, and attribute value to their pain, comparing with children six years and above³³. As we included only children up to 6 years old in this study, we failed to demonstrate any significant relation between children’s age, their caries experience, and parents’ catastrophic thoughts and proxy dental pain report. Probably, these children displayed more intense symptoms of discomfort with the dental treat-

ment itself (they were referred for sedation because they had a history of negative behavior in the dental chair) than with their cavities. Moreover, children can mask their pain signals because they fear the pain management (in this case, dental treatment)³⁴.

Anyway, children in our study had a high caries experience observed in the dental examination and a moderate pain level as reported by their parents. There was a weak to moderate correlation between caries experience and pain intensity, probably because of potentially chronic lesions that do not provoke pain. Likewise, higher DDQ-B scores were as-

sociated with a higher rate of caries experience¹⁸. On the other hand, a previous study²⁵, showed a relationship between catastrophic thoughts of parents and dental pain at night in children; however, the frequency of nocturnal dental pain was low in our investigation.

One of the strengths of this study is that a validated questionnaire was used to verify toothache in young Brazilian children. Although we used a bootstrapping method for the statistical estimates, one cannot deny the limited, albeit controlled, sample size. We included clinical participants, giving a more realistic context, but all children had caries, and most parents were catastrophizing and female. Additional research with larger samples and greater representativeness, including children without cavities, non-catastrophizing parents, and catastrophizing fathers, could eliminate potential biases.

All in all, this study highlights the need for researchers' attention on the assessment of oral pain in children. Discoveries in this specific area may help elucidate more systemic aspects of pain management in children.

CONCLUSIONS

Catastrophizing children's pain by the parents did not influence the direct relationship between caries experience and perceived toothache in early childhood. Also, the child's age does not interact with this relationship.

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DECLARATIONS OF INTEREST

None.

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