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Original Reports

Reframe the Pain: A Randomized Controlled Trial of a Parent-Led Memory-Reframing Intervention

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Abstract: **Negatively-biased pain memories (ie, recalling more pain as compared to earlier reports) are a robust predictor of future pain experiences. This randomized controlled trial examined the efficacy of a memory-reframing intervention to reframe children's pain memories. Sixty-five children (54% girls, M_{age}=5.35 years) underwent a tonsillectomy and reported their levels of post-surgical pain intensity and pain-related fear. 2 weeks post-surgery, children and 1 of their parents were randomized to the memory-reframing intervention or control group. Following control/intervention instructions, parents and children reminisced about the past surgery as they normally would (control) or using the memory-reframing strategies (intervention). Children recalled their post-surgical pain intensity and pain-related fear one week later. Parents reported the intervention's acceptability. Recruitment statistics were used to assess feasibility. Controlling for initial pain intensity ratings and using the Faces Pain Scale Revised, children in the intervention group reported more accurate/positively-biased memories for day 1 post-surgery pain intensity (M = 2.60/10; 95% CI, 1.62 to 3.68), compared to children in the control group (M = 4.11/10; 95% CI, 3.12 to 5.03), η_p^2 = .07, p = .040. The intervention was acceptable and feasible. Optimal parent-child reminiscing about a past pain experience resulted in children remembering their pain more accurately/positively. Clinicaltrials.gov: NCT03538730.**

Perspective: ***This article presents results of the first randomized controlled trial examining the efficacy of parent-led memory-reframing intervention to change children's memories for pain. Children of parents who were taught and engaged in optimal reminiscing about a past surgery experience remembered their pain intensity more accurately/positively.***

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Key words: *Parent-child reminiscing, memory-reframing intervention, post-surgical pain, pediatric pain, memory for pain.*

Pain in childhood is ubiquitous and occurs across a variety of settings (eg, injuries, procedural, illness-related pain). How pain is managed in childhood sets the stage for pain experiences into adulthood with poorly managed pain leading to long-term consequences (eg, fear of needles,[26] healthcare avoidance.[40]) To date, pediatric pain management has focused on the child's immediate pain experience.[50] However, children's memories of *past* pain are a more robust predictor of future pain and distress than their actual initial experience of pain itself.[30] Children's memories for pain are susceptible to recall inaccuracies. Compared to their initial report, children can recall their pain accurately (ie, the same level of pain) or in a positively-(ie, lower level of pain) or negatively-(ie, higher level of pain) biased way. Children who develop negatively-biased pain memories are at heightened risk for increased pain[30]

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and distress[8] during future painful experiences and chronic pain.[35]

Given the malleability of children's memories for pain and their critical importance for future pain trajectories,[32] children's pain memories may be a fruitful intervention target in pediatric pain management. To-date, three randomized controlled trials (RCTs) of memory-reframing interventions have been conducted to reframe children's memories for pain.[5,7,43] All interventions were delivered immediately following a needle procedure (lumbar puncture,[7] dental injection,[43] vaccine injection[5]) by study personnel. These brief interventions involved the adults reminiscing about the past painful experience with children and identifying positive aspects, correcting negative exaggerations/biases in memory, and instilling children with self-efficacy about their ability to cope with pain (eg, commending their bravery, identifying instances where the child used effective coping strategies). The interventions were efficacious in reducing negative biases in children's pain memories.[32]

A limitation of this research is that these interventions were all conducted by researchers. Parents are powerful, yet underutilized, agents of change in the context of memory-reframing interventions.[29] The way that parents and children talk, or reminisce, about past painful events is a powerful predictor of how children later remember pain.[34] Specifically, if parents used more positive emotion words (eg, happy, laugh) and less pain-related words (eg, hurt, sore) when reminiscing about a recent tonsillectomy, their young children developed more accurate or positively-biased memories of pain intensity and pain-related fear.[34] When talking about past painful vs sad events, parents tend to be less elaborative, use less emotion-laden language, and express less support,[41] underscoring the need for parents to learn more optimal ways of reminiscing with children about past pain. Parent reminiscing style is malleable and can be changed using simple language-based interventions.[52] Yet, no studies to date have examined whether parents, similar to researchers, can accurately or positively reframe children's memories for pain using reminiscing strategies. This RCT aimed to fill the gap. Given the efficacy of existing memory-reframing interventions for needle pain[32] and the influence of parent-child reminiscing on children's pain memories.[34] we hypothesized that: 1) children in the memory-reframing intervention, vs control, group would have more accurate/positively-biased memories for post-surgical pain; 2) the intervention would be feasible and acceptable; 3) parents randomized to the intervention, vs control, group would use more intervention-consistent language (ie, more explanations and words associated with positive emotions and coping, and less words associated with negative emotions, anxiety/fear, and pain). An exploratory aim of the RCT was to examine the influence of individual differences on the efficacy of the intervention.

Methods

Trial Design

This pre-registered randomized controlled trial had parallel group assignment with 1:1 allocation ratio and blinded assessment of primary outcomes (NCT03538730; clinicaltrials.gov, posted May 29, 2018). There were no changes to the trial protocol after study commencement. Parent-child dyads were recruited from January 2018 to June 2019. The recruitment ended once the registered minimum sample size[1] (n = 52 with additional 34 dyads to account for attrition) was reached. Eligible families were contacted 1-3 weeks prior to their tonsillectomy and sent online consent forms and socio-demographic questionnaires.[14] Data were collected using a study protocol (Fig 1). Children reported their pain intensity and pain-related fear after tonsillectomy on the day of surgery (DOS) and on the Days 1-3, 7, and 14 post-surgery using validated faces pain scales.[15,25] The DOS pain ratings were obtained by trained research staff. In line with previous research[17,34] and prior to discharge from the hospital, parents were instructed how to administer the scales to their children at home.[17] At 2 weeks post-surgery, the timepoint at which tonsillectomy post-surgical pain typically subsides,[17] parents and children came to the hospital for a laboratory visit during which time each parent received either intervention or control instructions (see Interventions section) while their child played in a separate room. The same researcher, a clinical psychology graduate student, provided control and intervention instructions; instructions were audio-taped for intervention adherence coding. Then, parents and children engaged in a reminiscing task[34,47] in which they talked together about the child's recent tonsillectomy (ie, the day of the surgery and first days post-surgery) either as they normally would (control) or using the memory-reframing strategies (intervention) with no time limit.[41] Parent-child reminiscing was video- and audio-taped, transcribed verbatim, and coded by a blinded coder for intervention adherence using a coding scheme[47] previously used in the same population.[34,41]

In line with previous research examining similarly aged children undergoing tonsillectomy,[12,34] at 3-4 weeks post-surgery children in both groups completed an established memory interview by telephone[30] to assess children's memory for their post-surgical pain intensity and pain-related fear on DOS and Day 1 post-surgery. Interviews were conducted by trained, blinded research assistants and audio-recorded. The same faces pain scales previously administered were used to assess children's memories for pain intensity and pain-related fear. At the end of the interview, the interviewer opened a sealed envelope containing the participant's group allocation; parents in the intervention group then rated intervention acceptability and reported whether or not they used the intervention principles

[1]The sample size of 52 participants is specified in the study protocol registered on clinicaltrials.gov https://clinicaltrials.gov/ProvidedDocs/30/NCT03538730/Prot_SAP_000.pdf

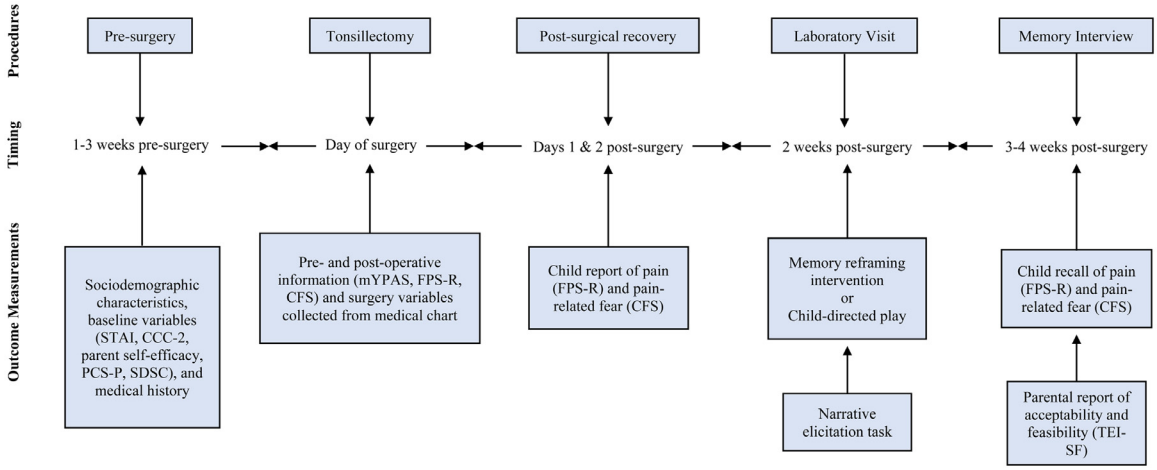


Figure 1. Study procedures. Abbreviations: STAI, the state-trait anxiety inventory; CCC-2, children's communication checklist-2; PCS-P, pain-catastrophizing scale-parent; SDSC, sleep disturbance scale for children; mYPAS, the modified yale preoperative anxiety scale; FPS-R, the faces pain scale-revised; CFS, the children's fear scale; TEI-SF, treatment evaluation inventory-short form.

after the laboratory visit. Parents in the control group received a handout summarizing the intervention principles via email.

Randomization and Blinding

Block randomization (1:1) was performed by an independent researcher using a random number generator.[51] A different researcher blinded to study hypotheses concealed group allocation using opaque, sequentially numbered, sealed envelopes. Group allocation was concealed from the interventionist and other investigators. At the start of the lab visit, the interventionist opened the envelope corresponding to the participant number which revealed group allocation and delivered the instructions according to the randomized condition. Other investigators remained blind to study condition until the end of the memory interview; group allocation was revealed to the memory interviewer to perform the appropriate debriefing. Statistical analyses were performed by first and senior authors (MP, MN) after data collection was complete.

Participants

86 children aged 4-7 years and one of their parents were recruited from the Ear Nose and Throat Clinic at a children's hospital in Western Canada. Children were eligible for the study if they were between 4-7 years old, scheduled to undergo a tonsillectomy, and able to understand and speak English. Children were excluded if they received anxiolytics prior to surgery, had a developmental disability and/or speech delay, and/or had an American Society of Anesthesiologists physical status ≥III.

The age range of 4-7 years was chosen as children's language abilities develop rapidly during this time, and children become equal conversational and reminiscing partners.[48] At the same time, children's cognitive abilities undergo rapid changes with autobiographical memory supplementing implicit memory (for reveiw, see [33]). During preschool years, parents remain children's key reminiscing partners[48] and influence the development of children's autobiographical memories, both general[42] and pain-specific.[12] Examining the intervention among children in this age range allowed us to capitalize on malleability of children's memory and draw upon parents' influential role on children's cognitions at this developmental stage.

Ethics

Children received standard pre- and post-surgical pain management; surgical teams followed standardized anesthesia and surgery protocols. The study was approved by the institution's research ethics board. There were no harm or unintended effects.

Interventions

Control Group

Similar to previous research,[52] parents in the control group were taught how to engage in child-directed play. Specifically, they were provided the rationale for and principles of child-directed play (ie, observing the child, following the child's lead, and playing at the child's pace).[9] To promote parents' attention and engagement, the researcher prompted parents to note their children's favorite activities and specific times during the week during which they can practice child-directed play if they wish. Parents also received a handout summarizing the child-directed play principle (Supplementary materials).

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Intervention Group

Parents in the intervention group were taught optimal ways of reminiscing with their child about the recent tonsillectomy. This standardized intervention was developed based on the efficacious[32] pain memory-reframing interventions for needle procedures[5,7,43] and findings from our recent observational data showing the influence of parent-child reminiscing about surgery on children's memories of tonsillectomy pain.[34] Parents were provided with a rationale for pain memory-reframing (ie, the role of pain memories in children's future pain-related distress and the malleability of pain memories). Parents then learned about 3 key principles of pain memory-reframing: 1.) elaborating on positive aspects of pain experience[5] and reducing the use of pain-related words[34]; 2.) decreasing any negative exaggerations in pain memories expressed by children [7]; 3.) praising children's bravery and pointing out specific ways that the child effectively coped with their pain. [43] In line with previous recommendations,[38] parents were encouraged to avoid deception (eg, saying it did not hurt) and use factual information. To facilitate personalized delivery of the intervention, the researcher elicited examples of positive things that occurred after the tonsillectomy, any distressing memories that children may have shared, and examples of pain coping strategies that parents and children found to be helpful. These examples were recorded and used by parents while reminiscing. Parents received a handout summarizing the memory-reframing techniques to use during the subsequent parent-child reminiscing task (Supplementary materials). Parents were not explicitly encouraged to use the memory-reframing principles after the lab visit, yet they could keep the handout.

Intervention Adherence

A standardized script with intervention and control instructions was developed by first and senior authors (MP, MN). Delivery of intervention/control instructions was audio-recorded for interventionist adherence coding using an adherence checklist (Supplementary materials). Participants' adherence to the intervention was coded using a narrative coding scheme (see Secondary outcomes: Parent-child narratives). 2 researchers blind to group allocation coded 20% (n = 13) of the intervention/control instructions with inter-coder reliability > .99 (Cohen's kappa).

Outcomes

Primary Outcome

Children's memory biases for pain intensity and children's memory biases for pain-related fear on DOS and Day 1 post-surgery were the primary outcome. Similar to previous research, memory biases were operationally defined as a deviation between the recalled pain intensity and pain-related fear ratings and the initial corresponding ratings. [30,34] Negatively-biased pain memories were defined as recalling higher levels of pain intensity and pain-related fear than initial ratings. Positively-biased pain memories were defined as lower levels of recalled pain intensity and pain-related fear than initial ratings.

At 3-4 weeks post-surgery, a trained researcher blind to the study condition conducted an established telephone memory interview with children.[30] Children were asked to recall their pain intensity and pain-related fear on DOS and Day 1 post-surgery (ie, the same timepoints as children's initial pain reports). The timepoints were chosen to assess children's memory for pain at times when it is typically most severe.[17] The same faces pain scales[15,25] used to assess initial reports of pain (described below) were used in the memory interview.[12,34] Each question was anchored with a specific time frame and location (ie, referring to DOS at the hospital and Day 1 post-surgery at home).

Secondary Outcomes

Child Pain Intensity and Pain-Related Fear

Were assessed on the DOS, Days 1-3, 7, and 14 post-surgery to capture the sensory and affective dimensions of the initial/present multidimensional pain experience.[34,39] The Faces Pain Scale Revised (FPS-R) was used to assess children's initial and recalled pain intensity.[15] Children rated their pain intensity by pointing to 1 of 6 faces that ranged in pain expression from neutral (0) to extreme pain (10). The Children's Fear Scale (CFS) was used to assess children's initial and recalled pain-related fear[25]. The CFS depicts 5 faces with a varying range of fear from 'not at all scared' (0) to 'most scared possible' (4). The FPS-R and CFS have demonstrated good psychometric properties and been used to assess initial and recalled pain in children aged 4-12 years.[30,34]

Parent-Child Narratives

Narratives obtained during the lab visit were video-recorded, transcribed, and broken down into utterances. An adapted version of the previously published[41] narrative coding scheme was used to code for content (ie, 6 codes: positive emotion words, negative emotion words, anxiety/fear words, pain words, words related to coping strategies, and bravery words) that directly referred to intervention instructions. Specifically, parents talking about positive aspects of past pain experience (ie, the first principle) would result in more frequent use of positive emotion words and less frequent use of negative emotion words. Parent reframing of distressing pain memories (ie, the second principle) would result in lower frequency of pain-related and anxiety/fear-related words. Finally, parent emphasis on coping strategies (ie, the third principle) would be related to more words associated with coping. An additional content code (ie, words related to bravery) was included to code parents' adherence to praising children's bravery (ie, a component of the third principle). To account for varying lengths of parent-child narratives, a proportion of each content code used over the total number of

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content codes used was calculated. To further examine parents' adherence to the second principle of the intervention (ie, reframing of children's distressing pain memories), 2 additional codes were created: 1) frequency of parents reframing children's expressed distressing memories; 2) frequency of parents not responding to children's expressed distressing memories. Intervention-consistent response would result in a lower frequency of parents not responding to distressing memories and higher frequency of parents reframing those memories. 2 researchers blind to group allocation (CN, MK) coded 20% (n = 13) of the narratives with inter-coder reliability $\geq$ .80 (Cohen's kappa), which is strong.[24] The primary coder (CN) coded the remaining narratives.

Intervention Feasibility and Acceptability

Recruitment statistics and parent report of their rapport with the interventionist as well as their motivation to learn and understand the intervention were used to assess intervention feasibility.[22] Parents randomized to the intervention group rated intervention acceptability using a 9-item Treatment Evaluation Inventory-Short Form[19] at the end of memory interview. The measure is reliable and valid[19]; internal consistency in the current sample was acceptable (Cronbach's alpha = 0.70). Parents reported whether or not they used the intervention principles with their children at home after the laboratory visit.

Additional variables

Well-validated measures were administered prior to surgery to describe the sample including parent anxiety (the State-Trait Anxiety Inventory),[49] parent catastrophic thinking about children's pain (Pain Catastrophizing Scale-Parent version),[13] children's language and communication skills (Children's Communication Checklist-2),[3] sleep quality (Sleep Disturbance Scale for Children),[6] and preoperative anxiety (modified Yale Preoperative Anxiety Scale).[18] Parents reported sociodemographic information and medical history. Researchers blind to group allocation extracted the following data regarding the children's surgeries from medical records (ie, surgery and anesthesia technique, post-surgery analgesia, PACU stay).

Sample Size and Power

An a priori power calculation was conducted using GPower (v.3.1.9.2) software.[11] An ANCOVA family of tests based on the primary outcome of children's pain memories was used. Based on effect sizes from previous memory-reframing interventions for needle pain [32] to detect a medium 0.5 effect size with a Type I error of 0.05 and 80% probability, a sample of 52 children was required. The effect size was based on the previous examinations[7] of memory-reframing interventions delivered by researchers. Thus, the sample size was sufficient to detect medium effects.

Statistical Methods

Data analyses were performed using SPSS(v.26).[16] Descriptive statistics characterized the sample and intervention acceptability. Independent samples t, $\chi 2$, and Fisher exact tests compared groups on sociodemographic variables. Similar to previous research,[30,34] the primary outcomes (ie, memory biases) were defined as a relative deviation between initial and recalled pain ratings within participants. Previous research[30,36] has demonstrated strong associations between children's initial pain reports and memory for pain. Similar to previous research, to control for the influence of initial pain reports on recalled pain, and to examine relative within-person deviations between initial pain reports and memory for pain, the initial pain ratings that corresponded to the memory score were included as covariates[30,34] in 1-way analysis of covariance (ANCOVA) models (eg, DOS pain intensity was covaried in models assessing memory of DOS pain intensity). The categorical variable was group allocation (ie, intervention or control). Child sex was another covariate in the analyses of primary outcomes. Positively-biased (ie, recalling less pain than initially reported) and accurate memories for pain were combined and compared with negatively-biased (ie, recalling more pain than initially reported) memories for pain. This grouping is in line with previous research findings demonstrating meaningful differences between children who overestimated their past pain (ie, had negatively-biased memories for pain), compared to children who recalled their pain accurately *or* underestimated their past pain (ie, had positively-biased memories for pain), as experiencing higher levels of distress during future painful procedures[30] (see Supplementary analyses for comparisons between negatively-biased, positively-biased, and accurate memories for pain). The primary outcome was analyzed using intent-to-treat approach. The Benjamin-Hochberg-corrected alphas were obtained for each family of tests (ie, day of the surgery outcomes; day 1 after surgery outcomes).[1] Given pre-registered hypotheses and, thus, 1-tail testing, we chose a 10% false discovery rate.

Additionally, we conducted exploratory analyses to examine the influence of children's (ie, age, sex, communication skills, sleep disturbances, perioperative anxiety [four subscales]) and parents' (ie, parent role, income, education, ethnicity, trait and state anxiety, catastrophic thinking about pain, pain-related self-efficacy) individual characteristics on intervention efficacy using partial correlations between the individual predictors and children's memories for pain intensity and pain-related fear on the day of the surgery and on day 1 after surgery, while controlling for the initial pain and fear ratings. Only children-parent dyads who were randomized to, and who received, the intervention were included in these analyses (n = 29). Bonferroni-corrected alpha levels (α = .006) were used to control for Type I error in these post-hoc exploratory analyses.

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Results

The study was conducted from January 2018 to June 2019. We randomized 86 parent-child dyads (Fig 2). Eleven dyads withdrew from the study prior to surgery and did not complete the socio-demographic/initial assessment. 10 dyads did not complete the lab visit and memory interview. 1 dyad allocated to intervention did not complete the lab visit but completed the memory interview. Most dyads (55%) who withdrew from the study indicated they did not have time to participate in the study or could not be reached for follow-up. Data from 65 dyads were analyzed. There were no significant differences on the socio-demographic variables between dyads who completed and withdrew from the study ($P > .05$). Data were missing at random (Little MCAR test P = .46); no data imputations were performed.

The sample (92% mothers, 54% girls, child M_{age} = 5.35 years) was predominantly white and educated (64% of parents held a college degree) (Table 1). Most children (48%) presented with obstructive sleep apnea and underwent adenotonsillectomy. There were no statistically significant differences between the control and intervention groups on socio-demographic or surgery-related variables (Table 1, $P > .05$). Groups did not differ on initial and recalled levels of pain intensity and pain-related fear (Table 2) with the exception of initial ratings of pain-related fear on Days 2 and 3 post-surgery, where children in the control vs intervention group reported more pain-related fear (1.17 versus 0.52 out of 4, $P = .03$; 0.83 vs 0.33 out of 4, $P = .04$, respectively). On

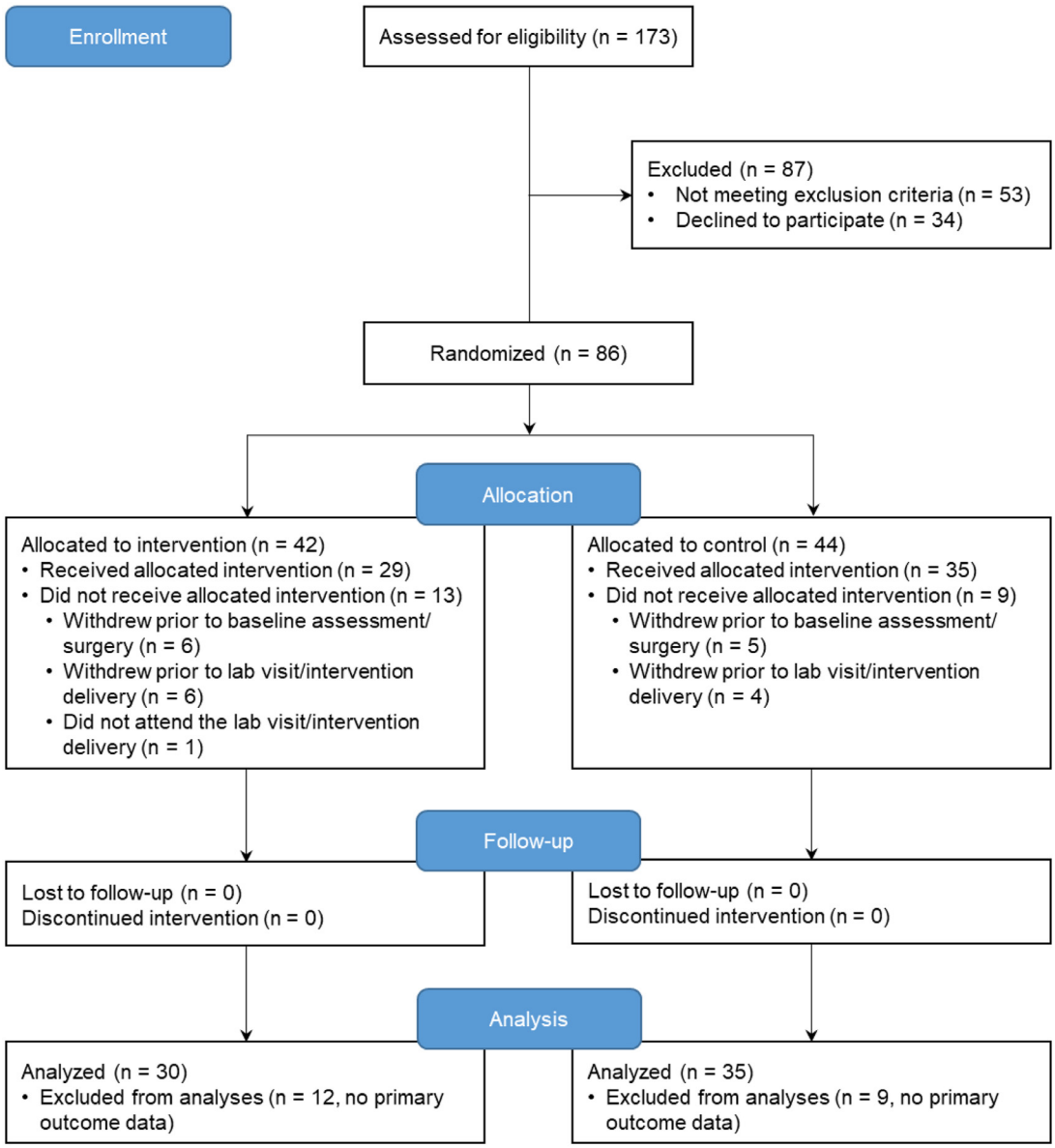


Figure 2. CONSORT flow diagram of trial participants. Enrollment and randomization of participants in the trial.

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Table 1. Demographics, Medical History, Secondary Outcomes, and Surgery Characteristics by Group

Variable	*Control group (n = 35)*	*Intervention group (n = 30)*	*Total (n = 65)*	P *value*[*]
Child age, years, *M (SD)*	5.49 (1.15)	5.20 (1.06)	5.35 (1.11)	.31
Child sex				
Girls	16 (46)[†]	19 (63)	35 (54)	.16
Boys	19 (54)	11 (37)	30 (46)	
Parent role				
Mothers	33 (94)	27 (90)	60 (92)	.52
Fathers	2 (6)	3 (10)	5 (8)	
Parent ethnicity				
Minority	6 (17)	9 (30)	15 (23)	.22
Non-minority	29 (83)	21 (70)	50 (77)	
Child ethnicity				
Minority	9 (26)	8 (27)	17 (26)	.93
Non-minority	26 (74)	22 (73)	48 (74)	
Annual household income				
< $70,000	5 (14)	5 (18)	10 (16)	.74
≥ $70,000	30 (86)	23 (82)	53 (84)	
Parent education				
High school/vocational school/some college	13 (37)	10 (34)	23 (36)	.83
College/graduate degree	22 (63)	19 (66)	41 (64)	
Marital Status				
Married/common-law	28 (80)	29 (97)	57 (88)	.06
Single/divorced	7 (20)	1 (3)	8 (12)	
Parent had a tonsillectomy				
No	19 (54)	19 (63)	38 (58)	.46
Yes	16 (46)	11 (37)	27 (42)	
Child had a previous surgery				
No	24 (69)	24 (80)	48 (74)	.30
Yes	11 (31)	6 (20)	17 (26)	
Parent surgery preparation[‡]				
No	10 (29)	11 (37)	21 (32)	.49
Yes	25 (71)	19 (63)	44 (68)	
Child language, CCC-2, *M (SD)*	84.88 (17.28)	84.86 (13.89)	84.87 (15.68)	.99
Parent anxiety (trait), STAI-T, *M (SD)*	34.83 (9.74)	37.43 (8.78)	36.03 (9.33)	.27
Parent anxiety (state), STAI-S, *M (SD)*	36.09 (10.36)	36.03 (11.91)	36.06 (11.01)	.99
Parent catastrophizing, PCS-P, *M (SD)*	20.43 (9.00)	17.80 (8.69)	19.22 (8.89)	.24
Parent pain-related self-efficacy[§], *M (SD)*	75.65 (22.90)	69.79 (25.40)	73.00 (24.04)	.34
Child sleep, SDSC, *M (SD)*	56.31 (13.99)	52.23 (14.80)	54.43 (14.40)	.26
Children's presenting diagnosis				
Obstructive sleep apnea	18 (51)	13 (43)	31 (48)	.62
Tonsillitis or other	17 (49)	17 (57)	34 (52)	
Parent present at the anesthesia induction				
No	9 (26)	3 (11)	12 (19)	.13
Yes	26 (74)	25 (89)	51 (81)	
Child preoperative anxiety, mYPAS Holding, *M (SD)*	31.08 (12.07)	30.00 (13.16)	30.59 (12.48)	.74
Child preoperative anxiety, mYPAS Separation, *M (SD)*	27.92 (7.32)	28.11 (9.25)	28.00 (8.182)	.93
Child preoperative anxiety, mYPAS Induction 1, *M (SD)*	31.46 (15.06)	28.57 (10.40)	30.16 (13.14)	.39
Child preoperative anxiety, mYPAS Induction 2, *M (SD)*	35.63 (20.11)	38.04 (22.73)	36.71 (21.19)	.66
Anesthesia technique				
Inhalation	32 (97)	28 (93)	60 (95)	.60
TIVA	1 (3)	2 (7)	3 (5)	
Surgery technique				
Adenotonsillectomy	15 (43)	16 (53)	31 (48)	.40
Adenotonsillectomy and other procedures	20 (57)	14 (47)	34 (52)	
Duration of PACU stay, min, *M (SD)*	47.80 (17.26)	52.67 (15.80)	50.05 (16.66)	
Parent present in PACU				
No	19 (56)	13 (43)	32 (50)	.32
Yes	15 (44)	17 (57)	32 (50)	
Overnight stay at the hospital				
No	19 (56)	21 (72)	40 (64)	.17
Yes	15 (44)	8 (28)	23 (36)	

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Table 1. Continued

Variable	Control group (n = 35)	Intervention group (n = 30)	Total (n = 65)	P value*
Analgesic administration at home, Days 1-3				
No	0 (0)	0 (0)	0 (0)	–¶
Yes	35 (100)	30 (100)	65 (100)	
Analgesic administration at home, Day 7				
No	3 (9)	3 (10)	6 (10)	>.99
Yes	30 (91)	27 (90)	57 (90)	
Analgesic administration at home, Day 14				
No	30 (91)	27 (93)	57 (92)	> .99
Yes	3 (9)	2 (7)	5 (8)	

Abbreviations: CCC-2, children's communication checklist; STAI-T, state-trait anxiety inventory (Trait); STAI-S, state-trait anxiety inventory (State); PCS-P, pain-catastrophizing scale-parent version; SDSC, sleep disturbance scale for children; mYPAS, the modified yale preoperative anxiety scale; TIVA, total intravenous anesthesia; PACU, post anesthesia care unit.
*Independent samples t-tests, chi square tests, or Fisher's exact tests.
†The percentages may not add up to 100 due to rounding up/down.
‡Parents were asked: In the period before the scheduled surgery, have you accessed any information relating to the surgery or post-surgical period?.
§Parents were asked: Based on all the things you have done to deal with your child's pain in the past, how confident are you that you could decrease your child's post-surgical pain if you tried?.
¶No *P* value was calculated as count in both groups is constant.

average, the primary outcome assessment (ie, memory interview) was completed 26.15 (*SD* = 5.03) days post-surgery and 9.63 (*SD* = 2.28) days post-intervention. There were no significant differences in primary outcome assessment dates as a function of group, $P > .05$.

Primary Outcome Analyses

Groups did not differ on memory biases for DOS pain intensity (η_p^2 = .001, *P* = .819) or pain-related fear (η_p^2 = .004, *P* = .640) (Table 3). Children in the intervention (*M* = 2.60/10; 95% CI, 1.62 to 3.68), vs control (*M* = 4.11/10; 95% CI, 3.12 to 5.03), group had more accurate/positively-biased memories for pain intensity on Day 1 post-surgery (η_p^2 = .07, *P* = .040). The finding was significant at the Benjamin-Hochberg-corrected alpha level of 0.05. Groups did not differ in their recall of pain-related fear on Day 1 post-surgery (η_p^2 = .05, *P* = .095).

Intervention Feasibility, Acceptability, and Adherence

Seventy-six percent (n = 65) of eligible participants completed the study; 69% (n = 29) of participants randomized to the intervention received it. Parents were motivated to learn the intervention (*M* = 7.90/10, *SD* = 1.92), understood the intervention's purpose (*M* = 8.69/10, *SD* = 2.14), and connected with the interventionist (*M* = 8.79/10, *SD* = 1.18). Parents rated the intervention to be highly acceptable (*M* = 41.97/45, *SD* = 3.02). The interventionist's adherence was 100%. Intervention instructions lasted longer compared to

Table 2. Initial Reports of and Memory for Pain Intensity and Pain-Related Fear by Group

Variable	Control group (n = 35)	Intervention group (n = 30)	Total (n = 65)	P value*
Initial report, *M* (*SD*)				
DOS pain intensity	1.47 (2.22)	2.20 (2.75)	1.81 (2.51)	.25
DOS pain-related fear	0.36 (0.65)	0.53 (1.01)	0.44 (0.84)	.43
Day 1 post-surgery pain intensity	2.57 (2.41)	3.40 (3.11)	2.95 (2.76)	.23
Day 1 post-surgery pain-related fear	0.91 (1.15)	0.83 (1.26)	0.88 (1.22)	.79
Day 2 post-surgery pain intensity	3.60 (2.65)	3.33 (3.65)	3.48 (3.13)	.74
Day 2 post-surgery pain-related fear	1.17 (1.27)	0.53 (1.07)	0.88 (1.22)	.03
Day 3 post-surgery pain intensity	3.54 (2.66)	2.93 (3.05)	3.26 (2.84)	.39
Day 3 post-surgery pain-related fear	0.83 (1.07)	0.33 (0.80)	0.60 (0.98)	.04
Day 7 post-surgery pain intensity	3.39 (3.02)	1.93 (2.60)	2.70 (2.90)	.05
Day 7 post-surgery pain-related fear	1.03 (1.13)	0.60 (1.16)	0.83 (1.16)	.14
Day 14 post-surgery pain intensity	0.61 (1.77)	0.14 (0.74)	0.39 (1.40)	.17
Day 14 post-surgery pain-related fear	0.27 (0.84)	0.10 (0.41)	0.19 (0.67)	.31
Memory for pain and pain-related fear, *M* (*SD*)				
Memory for DOS pain intensity	3.94 (3.80)	3.73 (3.59)	3.85 (3.68)	.82
Memory for DOS pain-related fear	1.00 (1.26)	1.00 (1.26)	1.00 (1.25)	> .99
Memory for Day 1 post-surgery pain intensity	3.89 (3.25)	2.87 (2.91)	3.42 (3.12)	.19
Memory for Day 1 post-surgery pain-related fear	1.31 (1.53)	0.77 (1.17)	1.06 (1.39)	.11

Abbreviation: DOS, day of surgery.
*Independent samples t-tests.

Table 3. Children's Memory Biases as a Function of Group

Criterion	Group (Adjusted Mean, 95% CI)*		Mean Differences† (95% CI)	F value	P value‡	η_p^2
	Control	Intervention				
Memory for pain intensity (DOS) (n = 64)	3.85 (2.62 to 5.08)	3.64 (2.33 to 4.95)	0.21 (-1.62−2.04)	0.05	.819	<.01
Memory for pain-related fear (DOS) (n = 63)	1.10 (0.67 to 1.50)	0.96 (0.54 to 1.38)	0.14 (-0.45−0.73)	0.22	.640	<.01
Memory for pain intensity (Day 1) (n = 65)	4.11 (3.12 to 5.08)	2.60 (1.56 to 3.65)	1.51 (0.07−2.95)	4.41	.040	.07
Memory for pain-related fear (Day 1) (n = 65)	1.33 (0.87 to 1.79)	0.75 (0.25 to 1.25)	0.58 (-0.11−1.27)	2.87	.095	.05

Abbreviation: DOS, day of surgery.
*The adjusted means are derived from the analyses of co-variance controlling for corresponding initial pain and pain-related fear ratings, as well as child sex.
†Control minus intervention group scores.
‡Analyses of covariance

control instructions (14.90 vs 10.71 min, $P < .001$). Ninety percent (n = 26) of parents in the intervention group reported using the intervention principles after the laboratory visit.

Parent-Child Narrative Analysis

Parents in the intervention group adhered to the intervention principles as evidenced by their use of significantly higher proportions of words associated with key memory-reframing principles as compared to parents in the control group (Table 4), $P < .01$. Specifically, parents in the intervention group used words associated with positive emotions, coping, and bravery more frequently and words associated with negative emotions, anxiety/fear, and pain less frequently. Parents in the intervention ($M = 0.55$, SD = 0.99), versus control ($M = 0.46$, SD = 1.17), group did not differ in their use of reframing responses when children expressed distressing pain memories, $P > .05$. However, parents in the control group ($M = 0.31$, $SD = 0.53$) missed an opportunity to reframe children's exaggerations more often, compared to parents in the intervention group ($M = 0.07$, $SD = 0.26$), t(51.15) = 2.42, $P = .019$.

Individual Predictors of Intervention Efficacy

Individual characteristics of parents and children were not significantly correlated with children's memories for pain and pain-related fear, when controlling for children's initial report of pain and pain-related fear, $P > .006$.

Discussion

This is the first trial of a parent-led intervention to reframe children's pain memories. Children in the intervention, versus control, group reported more accurate or positively-biased memories for pain intensity on Day 1 post-surgery. Parents reported the intervention to be highly acceptable. Recruitment and study completion rates indicated good feasibility.[22] While reminiscing about the past surgery, parents in the intervention, vs

Table 4. Narrative Codes of Parent-Child Reminiscing About Surgery by Group

Narrative codes	Memory-reframing principle	Intervention-congruent action	Control group (n = 35)	Intervention (n = 29)	Total (n = 64)	P value†
Positive emotion	(1) Focusing on positive aspects of pain experience	Use more	0.18 (0.14)*	0.31 (0.12)	0.24 (0.15)	< .001
Negative emotion	(1) Focusing on positive aspects of pain experience	Use less	0.21 (0.10)	0.08 (0.07)	0.15 (0.11)	< .001
Anxiety/fear	(2) Decreasing exaggerations in memories for pain/fear	Use less	0.14 (0.09)	0.05 (0.05)	0.10 (0.09)	< .001
Pain	(2) Decreasing exaggerations in memories for pain/fear	Use less	0.23 (0.16)	0.13 (0.10)	0.19 (0.15)	.004
Reframing of children's distressing memories	(2) Decreasing exaggerations in memories for pain/fear	Use more	0.55 (0.99)	0.46 (1.17)	0.50 (1.08)	.731
No response to children's distressing memories	(2) Decreasing exaggerations in memories for pain/fear	Use less	0.07 (0.26)	0.31 (0.53)	0.20 (0.44)	.019
Coping	(3) Building up pain-specific pain efficacy	Use more	0.23 (0.13)	0.34 (0.16)	0.28 (0.15)	.002
Bravery	(3) Building up pain-specific pain efficacy	Use more	0.01 (0.03)	0.09 (0.06)	0.05 (0.06)	< .001

*The values represent the proportion of words associated with each content theme over the total number of codes used.
†Independent samples t-tests.

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control, group used more intervention-consistent language. These findings provide preliminary evidence that children's pain memories following surgery can be changed to be more accurate or positive by teaching parents to reminisce with children in optimal ways. The intervention did not significantly impact children's memories for pain-related fear or children's memory for pain intensity on the day of surgery. Given the small study sample, assessment of short- versus long-term outcomes, and a significant change in one out of four primary outcomes, future large-scale trials of the intervention are needed.

Previous memory-reframing interventions for needle procedures were efficacious in positively reframing children's memories for pain following brief discussions with researchers.[5,7,43] These interventions involved reminiscing with children about the needle procedures and identifying positive aspects of the pain experience, correcting negative exaggerations in memories, and instilling children with self-efficacy about their ability to cope with pain.[5,7,43] Another observational study used a retrieval-induced forgetting technique to examine children's ability to *forget* distressing aspects of past painful experiences.[23] Findings revealed that children's ability to repeatedly recall positive aspects of a past painful event resulted in children forgetting its distressing aspects.[23] Our previous observational research showed that when parents reminisced with children about a past tonsillectomy using more words associated with positive emotions and less words associated with pain, their children later developed more accurate or positively-biased pain memories.[34] These studies informed the key components of the current memory-reframing intervention.

There were no significant changes in children's memories for pain that occurred on the day of the surgery as a result of the intervention. This may be due to the residual effects of general anesthesia on children's memory during the acute recovery (ie, first 12 hours) period.[27] Children's memory for pain-related fear on Day 1 post-surgery did not change as a result of the intervention, which may be due to the lack of variance in ratings of pain-related fear. Future iterations of the intervention may more explicitly address children's memories of pain-related fear. Given that fear is reduced by exposures to the feared stimuli,[28] repeated imaginal exposures in the form of reminiscing may produce reductions in children's memories for pain-related fear.

Exploratory analyses of individual predictors of intervention efficacy did not yield statistically significant results, which may be due to the small sample size. A conceptual model of, and previous research on, children's memories for acute pain posited procedural distress[8] and levels of trait[46] and state[31] anxiety to result in negatively-biased memories for pain. Larger future trials should investigate individual predictors of the intervention's efficacy.

Parents randomized to the intervention group, reminisced with their children using intervention-consistent words (eg, coping-, positive emotion-related words) more often compared with parents in the control group. This finding fits with previous research that revealed parent reminiscing style was amenable to change.[52] Application of key memory-reframing principles to parent-child reminiscing resulted in an intervention that is readily integrated in naturally occurring parent-child conversations. Indeed, most parents randomized to the intervention group reported using the intervention principles with their children. There were no significant differences between mothers and fathers in the use of narrative codes as a function of group allocation. Yet, given demonstrated differences in mother- vs father-reminiscing about past surgery,[34] it is important to examine adherence to the intervention and the use of intervention-consistent language as a function of parent role in future trials.

The memory-reframing intervention has limited clinical implications. Given a robust association between children's memories for pain and their experience of future pain,[7,30] this intervention may hold potential as a preventative pain management strategy. However, the small sample size qualifies the clinical significance of the findings; future investigations of the clinical implications are warranted. This is the first memory-reframing intervention for painful experiences that utilized *parents* as intervention agents. Parents, particularly in early childhood, have been argued to be the most powerful agents of change with regards to influencing their children's autobiographical memories.[48] Leading questions, yes-no vs open-ended questions, and repetition of inaccurate details of a past event lead to formation of false memories or merging of children's memory of a particular event with externally added details(ie, source errors).[4] Young children's autobiographical memories are particularly susceptible to such distortions, especially when such information is—intentionally or unintentionally—communicated by parents.[45]

Parent-child reminiscing creates a rich socio-linguistic context, where memories are reconstructed and assigned meaning in a safe environment, and specifically for medical experiences, when the distress, fear, and pain have subsided.[48] This memory-reframing intervention is more ethically acceptable. Previous studies[5] employed suggestions that may not have been true (eg, saying to a child that they did not cry). In the present study, parents were explicitly taught to validate and reframe children's memories using factual/correct information (eg, emphasizing positive details, correcting negative exaggerations in memory) from the children's surgical experience. Of note, remembering pain is evolutionary adaptive[44]; however, recalling more pain compared to the initial reports puts children at risk of being more distressed and experience more pain in the future.[30] *Overly* positive recall or reframing of past pain may prevent children from adequately preparing for future pain experiences and—in the context of traumatic pain—may indicate/promote maladaptive coping (eg, emotional numbing) and invalidation. Future investigations of the intervention should consider the context of children's pain experiences and modify the intervention if used with traumatic painful injuries.

This RCT is a pilot investigation of a memory-reframing intervention with a small sample size. The main

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outcome was assessed once 1 week after the intervention. Past research demonstrated that children's biased recall of past post-surgical pain persists for up to 1 year,[37] suggesting that the intervention's long-term efficacy warrants future examination. 25 percent of families who initially agreed to participate in the study were lost to follow-up either before or after surgery. We were unable to blind participants and the interventionist to group allocation, which is a common challenge in trials of psychological interventions.[2] However, researchers assessing the primary outcome were blind to group allocation, thus, reducing the risk of overestimating intervention efficacy. The sample was predominantly white limiting generalizability of findings. Indeed, parents and children of other cultural backgrounds may not ordinarily talk about pain.[20,21] Finally, the RCT was conducted prior to establishing the initial effectiveness of the memory-reframing intervention. Future examinations of the intervention effectiveness in other populations (eg, adolescents) should be preceded by pilot investigations.

Future trials should examine intervention efficacy in larger samples. The intervention could be augmented by providing parents with children's initial reports of pain, which may serve as another piece of evidence against negatively-biased/exaggerated recall and facilitate memory-reframing. Moreover, parents could be reminded to use the intervention in days following intervention instructions (eg, via text). Future studies should examine parent use of the intervention at home should be examined with more rigour (eg, how many times parents used the intervention, in what context). Accurate tracking of and encouragement to use the intervention strategies repeatedly may boost the intervention effect. Future research should also investigate the timing of the intervention (eg, before surgery) and a dose-response relationship between children's memories for pain and the length, frequency, and/or different media of the intervention (eg, video). The intervention may be expanded to target other potential contributors to pain memories (eg, parent anxiety).[12] Another way to augment the intervention is to further enhance pain resilience. Resilience has mostly been studied in the context of pediatric chronic pain with optimism, trait mindfulness, positive affect, and social/parent support as proposed sources of resilience, and pain-related self-efficacy and active coping as resilience mechanisms.[10] The third part of the intervention instructions emphasizes positive aspects of the past painful experience, children's pain-related self-efficacy, and pain coping strategies. These elements map onto sources of pain resilience outlined above. The act of reminiscing about past pain may provide parent support and add to children's pain-specific resilience. Elements of mindfulness and positive psychology may further enhance the intervention.

The intervention may be examined in the context of repeated and common painful procedures (eg, vaccinations) to investigate the effect of the intervention on children's future pain experience. We hypothesize that, similar to research in experimental pain,[30] memory biases would predict pain intensity during the second procedure, and children who received the intervention and formed accurate or positively-biased memories for pain would experience less pain. Finally, future research should confirm the generalizability of the intervention by including different interventionists and more diverse samples.

Conclusions

In conclusion, this study demonstrated feasibility, and acceptability of parent-led memory-reframing intervention in changing children's memories for post-surgical pain to be more accurate or positive. The intervention efficacy is qualified by the small sample size and need to be examined in larger trials.

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Supplementary data

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References

1. Benjamini Y, Cohen R: Weighted false discovery rate controlling procedures for clinical trials. Biostatistics 18:91-104, 2017

2. Birnie KA, Noel M, Chambers CT, Uman LS, Parker JA: Psychological interventions for needle-related procedural pain and distress in children and adolescents. Cochrane Database Syst Rev 10:CD005179, 2018

3. Bishop DVM: CCC-2: Children's Communication Checklist-2. San Antonio, TX, United States Edition, Manual, Pearsons, 2006

4. Bruck M, Ceci SJ: The suggestibility of children's memory. Annu Rev Psychol 50:419-439, 1999

ARTICLE IN PRESS

5. Bruck M, Ceci SJ, Francoeur E, Barr R: "I hardly cried when I got my shot!" Influencing children's reports about a visit to their pediatrician. Child Dev 66:193-208, 1995

6. Bruni O, Ottaviano S, Guidetti V, Romoli M, Innocenzi M, Cortesi F, Giannotti F, The Sleep Disturbance Scale for Children (SDSC): Construction and validation of an instrument to evaluate sleep disturbances in childhood and adolescence. J Sleep Res 5:251-261, 1996

7. Chen E, Zeltzer LK, Craske MG, Katz ER: Alteration of memory in the reduction of children's distress during repeated aversive medical procedures. J Consult Clin Psychol 67:481-490, 1999

8. Chen E, Zeltzer LK, Craske MG, Katz ER: Children's memories for painful cancer treatment procedures: Implications for distress. Child Dev 71:933-947, 2000

9. Child directed play: Seattle Children's Hospital. Available at: https://www.seattlechildrens.org/globalassets/documents/for-patients-and-families/ce/CE043-child-directed-play.pdf Seattle, WA

10. Cousins LA, Kalapurakkel S, Cohen LL, Simons LE: Topical review: Resilience resources and mechanisms in pediatric chronic pain. J Pediatr Psychol 40:840-845, 2015

11. Faul F, Erdfelder E, Lang AG, Buchner A: G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods 39:175-191, 2007

12. Fischer S, Vinall J, Pavlova M, Graham S, Jordan A, Chorney J, Rasic N, Brookes JT, Hoy M, Yunker WK, Noel M: The role of anxiety in young children's pain memory development following surgery. Pain 160:965-972, 2018

13. Goubert L, Eccleston C, Vervoort T, Jordan A, Crombez G: Parental catastrophizing about their child's pain. The parent version of the Pain Catastrophizing Scale (PCS-P): A preliminary validation. Pain 123:254-263, 2006

14. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG: Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 42:377-381, 2009

15. Hicks CL, von Baeyer CL, Spafford PA, van Korlaar I, Goodenough B: The faces pain scale-revised: Toward a common metric in pediatric pain measurement. Pain 93:173-183, 2001

16. IBM Corp: IBM SPSS Statistics for Windows. Armonk, NY, IBM Corp., 2019

17. Kain ZN, Mayes LC, Caldwell-Andrews AA, Karas DE, McClain BC: Preoperative anxiety, postoperative pain, and behavioral recovery in young children undergoing surgery. Pediatrics 118:651-658, 2006

18. Kain ZN, Mayes LC, Cicchetti DV, Bagnall AL, Finley JD, Hofstadter MB: The yale preoperative anxiety scale: How does it compare with a "gold standard"? Anesth Analg 85:783-788, 1997

19. Kelley ML, Heffer RW, Gresham FM, Elliott SN: Development of a modified treatment evaluation inventory. J Psychopathol Behav Assess 11:235-247, 1989

20. Latimer M, Simandl D, Finley A, Rudderham S, Harman K, Young S, MacLeod E, Hutt-MacLeod D, Francis J: Understanding the impact of the pain experience on aboriginal children's wellbeing: Viewing through a 2-eyed seeing lens. First Peoples Child Family Rev 9:22-37, 2014

21. Latimer M, Young S, Dell C, Finley GA: Aboriginal children and physical pain: What do we know? J Aboriginal Health 9:7-14, 2012

22. Law EF, Fales JL, Beals-Erickson SE, Failo A, Logan D, Randall E, Weiss K, Durkin L, Palermo TM: A single-arm feasibility trial of problem-solving skills training for parents of children with idiopathic chronic pain conditions receiving intensive pain rehabilitation. J Pediatr Psychol 42:422-433, 2017

23. Marche TA, Briere JL, von Baeyer CL: Children's Forgetting of Pain-Related Memories. J Pediatr Psychol 41:220-231, 2016

24. McHugh ML: Interrater reliability: The kappa statistic. Biochem Med (Zagreb) 22:276-282, 2012

25. McMurtry CM, Noel M, Chambers CT, McGrath PJ: Children's fear during procedural pain: Preliminary investigation of the Children's Fear Scale. Health Psychol 30:780-788, 2011

26. McMurtry CM, Pillai Riddell R, Taddio A, Racine N, Asmundson GJ, Noel M, Chambers CT, Shah V, HelpinKids, Adults T: Far From "Just a Poke": Common painful needle procedures and the development of needle fear. Clin J Pain 31:S3-11, 2015

27. Millar K, Asbury AJ, Bowman AW, Hosey MT, Musiello T, Welbury RR: The effects of brief sevoflurane-nitrous oxide anaesthesia upon children's postoperative cognition and behaviour. Anaesthesia 61:541-547, 2006

28. Moscovitch DA, Antony MM, Swinson RP, Moscovitch DA, Antony MM, Swinson RP: Oxford library of psychology, in Antony MM, Stein MB, (eds): Oxford Handbook of Anxiety and Related Disorders, Oxford University Press, 2009, pp 461-475

29. Noel M: Commentary: Harnessing the fragility of pain memories to help children forget: a new avenue for pediatric psychology interventions? J Pediatr Psychol 41:232-234, 2016

30. Noel M, Chambers CT, McGrath PJ, Klein RM, Stewart SH: The influence of children's pain memories on subsequent pain experience. Pain 153:1563-1572, 2012

31. Noel M, Chambers CT, McGrath PJ, Klein RM, Stewart SH: The role of state anxiety in children's memories for pain. J Pediatr Psychol 37:567-579, 2012

32. Noel M, McMurtry CM, Pavlova M, Taddio A: Brief clinical report: A systematic review and meta-analysis of pain memory-reframing interventions for children's needle procedures. Pain Pract 18:123-129, 2018

33. Noel M, Palermo TM, Chambers CT, Taddio A, Hermann C: Remembering the pain of childhood: Applying a developmental perspective to the study of pain memories. Pain 156:31-34, 2015

34. Noel M, Pavlova M, Lund T, Jordan A, Chorney J, Rasic N, Brookes J, Hoy M, Yunker WK, Graham S: The role of narrative in the development of children's pain memories: influences of father- and mother-child reminiscing on children's recall of pain. Pain 160:1866-1875, 2019

ARTICLE IN PRESS

35. Noel M, Rabbitts JA, Fales J, Chorney J, Palermo TM: The influence of pain memories on children's and adolescents' post-surgical pain experience: A longitudinal dyadic analysis. Health Psychol 36:987-995, 2017

36. Noel M, Rabbitts JA, Tai GG, Palermo TM: Remembering pain after surgery: A longitudinal examination of the role of pain catastrophizing in children's and parents' recall. Pain 156:800-808, 2015

37. Noel M, Rosenbloom B, Pavlova M, Campbell F, Isaac L, Page MG, Stinson J, Katz J: Remembering the pain of surgery 1 year later: A longitudinal examination of anxiety in children's pain memory development. Pain 160:1729-1739, 2019

38. Noel M, Taddio A, McMurtry CM, Chambers CT, Pillai Riddell R, Shah V, HelpinKids, Adults T: HELPinKids&Adults knowledge synthesis of the management of vaccination pain and high levels of needle fear: Limitations of the evidence and recommendations for future research. Clin J Pain 31:S124-S131, 2015

39. Ornstein PA, Manning EL, Pelphrey KA: Children's memory for pain. J Dev Behav Pediatr 20:262-277, 1999

40. Pate JT, Blount RL, Cohen LL, Smith AJ: Childhood medical experience and temperament as predictors of adult functioning in medical situations. Child Health Care 25:281-298, 1996

41. Pavlova M, Graham SA, Jordan A, Chorney J, Vinall J, Rasic N, Brookes J, Hoy M, Yunker W, Noel M: Socialization of pain memories: Parent-child reminiscing about past painful and sad events. J Pediatr Psychol 44:679-691, 2019

42. Peterson C, Sales JM, Rees M, Fivush R: Parent-child talk and children's memory for stressful events. Appl Cogn Psychol 21:1057-1075, 2007

43. Pickrell JE, Heima M, Weinstein P, Coolidge T, Coldwell SE, Skaret E, Castillo J, Milgrom P: Using memory restructuring strategy to enhance dental behaviour. Int J Paediatr Dent 17:439-448, 2007

44. Price TJ, Inyang KE: Commonalities between pain and memory mechanisms and their meaning for understanding chronic pain. Prog Mol Biol Transl Sci 131:409-434, 2015

45. Ricci CM, Beal CR, Dekle DJ: The effect of parent vs unfamiliar interviewers on children's eyewitness memory and identification accuracy. Law Hum Behav 20:483-500, 1996

46. Rocha EM, Marche TA, von Baeyer CL: Anxiety influences children's memory for procedural pain. Pain Res Manag 14:233-237, 2009

47. Sales JM, Fivush R, Peterson C: Parental reminiscing about positive and negative events. J Cognit Develop 4:185-209, 2003

48. Salmon K, Reese E: The benefits of reminiscing with young children. Curr Dir Psychol Sci 25:233-238, 2016

49. Spielberger CD: State-Trait Anxiety Inventory: A Comprehensive Bibliography. Palo Alto, CA, Consulting Psychologists Press, 1984

50. Taddio A, McMurtry CM, Shah V, Riddell RP, Chambers CT, Noel M, MacDonald NE, Rogers J, Bucci LM, Mousmanis P, Lang E, Halperin SA, Bowles S, Halpert C, Ipp M, Asmundson GJ, Rieder MJ, Robson K, Uleryk E, Antony MM, Dubey V, Hanrahan A, Lockett D, Scott J, E Votta Bleeker, HELPinKids&Adults Team: Reducing pain during vaccine injections: Clinical practice guideline. CMAJ 187:975-982, 2015

51. Urbaniak GC, Plous S: Research Randomizer. Available at: https://www.randomizer.org/

52. Van Bergen P, Salmon K, Dadds MR, Allen J: The effects of mother training in emotion-rich, elaborative reminiscing on children's shared recall and emotion knowledge. J Cognit Develop 10:162-187, 2009