

Is pain during pediatric dental sedation associated with children's pre-operative characteristics? An exploratory study

Dor durante sedação em odontopediatria associa-se a características pré-operatórias da criança? Estudo exploratório

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Resumo

Introdução: Pouco se sabe sobre os fatores associados à dor das crianças no tratamento odontológico sob sedação consciente. **Objetivo:** Verificar a associação entre as características pré-operatórias e a dor durante o tratamento odontopediátrico sob sedação. **Material e método:** Este estudo exploratório foi realizado com 27 crianças submetidas a tratamento restaurador sob sedação. As informações sobre idade, sexo e experiência de tratamento odontológico prévio da criança foram obtidas por meio de entrevista aos pais. A condição bucal, determinada a partir da presença de cárie dentária, foi verificada por meio do índice ceo-d. A dor foi avaliada por análise dos vídeos dos tratamentos, por dois examinadores previamente calibrados, utilizando-se os itens “pernas”, “atividade” e “choro” da escala observacional “Face, pernas, atividade, consolabilidade e choro” (FLACC). Os dados foram analisados por meio de testes bivariados. **Resultado:** A maioria das crianças (n=14; 51,8%) não teve dor durante o tratamento odontológico sob sedação. Entre as demais crianças, observaram-se escores de dor baixos ou moderados (mediana 1,1; mínimo 0-3,8). Os escores FLACC não diferiram conforme sexo (P=0,38), experiência prévia de tratamento odontológico (P=0,32) e história de anestesia local (P=0,96). Os escores FLACC não se correlacionaram significativamente com idade (Spearman rho= -0,08; P=0,67) e ceo-d (Spearman rho= -0,04, P=0,84). **Conclusão:** Neste grupo de crianças, a dor durante tratamento odontológico sob sedação foi pouco observada, de baixa intensidade e não se associou a idade, sexo, condição bucal e experiência odontológica anterior.

Descritores: Pré-escolar; sedação consciente; avaliação da dor; cárie dentária; assistência odontológica para crianças; anestesia dentária.

Abstract

Introduction: Little is known about the factors associated with the pain of children in dental treatment under conscious sedation. **Objective:** To investigate the association between preoperative characteristics and pain during pediatric dental treatment under sedation. **Material and method:** This exploratory study was conducted with 27 children in restorative treatment under sedation. Information on age, sex and experience of the children with previous dental treatment was obtained through interviews with parents. Oral health status, determined from the presence of dental caries, was verified using the dmft-t index. Pain was assessed by analyzing videos of the dental treatments by two previously calibrated examiners, using the items “legs”, “activity” and “crying” of the observational scale “face, legs, activity, consolability and crying” (FLACC). Data were analyzed using bivariate tests. **Result:** Most of the children (n=14, 51.8%) had no pain during dental treatment under sedation. Among the other children, lower or moderate pain scores (median 1.1; minimum 0 to 3.8) were observed. The FLACC scores did not vary according to sex (P=0.38), previous experience with dental treatment (P=0.32) and history with local anesthesia (P=0.96). The FLACC scores did not correlate significantly with age (Spearman rho= -0.08, P=0.67) and dmft-t (Spearman rho= -0.04, P=0.84). **Conclusion:** In this group of children, pain during dental treatment under sedation was of low frequency and intensity and did not associate with age, sex, oral condition and previous dental experience.

Descriptors: Preschool; conscious sedation; pain assessment; dental caries; dental care for children; dental anesthesia.

INTRODUCTION

Pain assessment in children is essential for identifying the damage that caused this unpleasant sensation and for providing the necessary care^{1,2}. This assessment is not always easy, due to the limitations of verbalization of small children^{3,4} and possible individual differences in the ways they react to pain⁵. Given these difficulties, observational scales have been used to assess pain, mainly in areas such as medicine⁶ and nursing⁷.

Among these scales is the FLACC (*F = face, L = legs, A = activity, C = Consolability, C = crying*), indicated for the assessment of pain in children from two to seven years of age⁸. The FLACC allows the assessment of behaviors related to pain, considering facial expressions, leg movements, activity, crying and consolability⁸. In pediatric dentistry, the FLACC has been used in studies comparing anesthetic techniques^{9,10}, the removal of carious tissue¹¹ and the assessment of children's behavior¹².

The perception of pain in children is associated with several cognitive, emotional and social factors¹³. Previous experience of painful procedures is one of the factors associated with the greater possibility of pain in subsequent procedures. Children who suffered during a painful procedure, like a lumbar puncture¹⁴, tend to have a more negative memory of the event, compared with those who did not suffer and they become more anxious in future procedures¹³.

In addition to previous experience with painful procedures, the perception of pain is related to the age of the child. According to a study conducted with children who underwent a painful medical procedure, older children can recall these procedures more easily and in greater detail, compared to younger children¹⁴. In dentistry, there is a scarcity of studies regarding factors associated with pain in children.

Considering that anxiety may exacerbate the perception of pain, it is desirable to use means such as sedation to reduce the occurrence thereof. Conscious sedation is an effective means of reducing anxiety¹⁵, in addition to having a temporary amnesia effect¹⁶. This amnesia effect could be of interest with patients undergoing potentially painful procedures, as it would reduce the chance that the child associate future procedures with previously vivid painful sensations. Despite these satisfactory effects with sedation, there is still no evidence regarding the influence of events during the pre-operative period and of children's characteristics in the experience of pain during dental procedures performed under sedation.

The investigation of these factors is important for establishing a dental treatment protocol appropriate to the patient, in order to minimize or control factors related to pain. Furthermore, reconciling conscious sedation to control factors associated with the experience of pain seems to be an effective path to successful pediatric dental treatment.

Therefore, the objective of the present study was to verify factors associated with the occurrence of pain during dental treatment of children undergoing conscious sedation.

MATERIAL AND METHOD

Type of Research and Place of Study

This cross-sectional study was conducted in the clinic of the extension project "Center for Studies of Sedation in Dentistry" (CSSD), of the College of Dentistry at the Universidade Federal de Goiás (FOUFG) (Federal University of Goiás).

Population and Sample

The population for the present study included preschool children sent from the services connected to the *Sistema Único de Saúde* (Public Health System) (SUS) to the FOUFG for dental sedation. The present study included all the children that participated in a randomized clinical trial (n=27; registered in the *clinical trials* database: NCT02284204). These children were healthy, were between three and seven years old, presented carious lesions requiring restoration and needed conscious sedation. Children were excluded if it were not possible to analyze the videos produced during sedation.

Ethical Aspects

The present study was approved by the Committee for Ethics in Research of the *Universidade Federal de Goiás* (Federal University of Goiás) (protocol n° 307/2011, dated 31 October, 2011). Parents signed the free and informed consent form, authorizing the participation of the children for whom they are the legal guardians.

Dental Sedation Procedures

Initially, the children underwent the clinical oral exam to verify the presence of carious lesions requiring restoration and a medical exam to confirm the possibility of sedation. In this consult, information was also collected about age, sex, previous treatment and dental anesthesia experiences, and the presence of dental caries (dmf-t index), among others.

In the subsequent consultation, the child received the following sedatives orally: Midazolam Dormire® (Laboratório Cristália, São Paulo, Brasil), 0.5mg/kg (maximum dose of 20mg); and, Ketamine® (Laboratório Cristália, São Paulo, Brasil), 3.0mg/kg (maximum dose of 50mg). The Ketamine was used orally; it is only available commercially for intravenous administration. In Brazil, this medication is not available for oral use. After 15 minutes, the patient was sent to the dental office. There, the child received a mask for inhaling 100% oxygen or sevoflurane (5L/min for 5 minutes). The entire sedative protocol followed the safety guidelines of the American Academy of Pediatric Dentistry¹⁷.

During the sedation session, the child received the restorative treatment, performed by a pediatric dentist with an assistant, under local anesthesia (2% lidocaine with epinephrine 1:100,000) and absolute isolation. One upper or lower primary molar was restored during that consultation. The mother remained seated in a chair next to the child throughout the entire procedure.

Assessment of Pain

The clinical exams and the treatment were filmed without the child realizing it. The films were used in the assessment of the children's behavior. The assessment of behavior was conducted using an adaptation of the FLACC scale^{8,18,19}. The scale is simple and has five categories that can each have a score from zero to two, with zero being a behavior that shows tranquility of the child/absence of pain and two being a behavior that shows severe pain (Table 1). Thus, the final score on the scale could range from zero to ten^{8,18,19}. In the present study, the category "face" was not assessed due to the impossibility of seeing the child's face, in detail, in the films. It was also not possible to assess the category "Consolability" since the children were sedated. With these modifications, the final score of the scale could range from zero to six.

The videos were viewed by two trained and calibrated observers who assigned scores from the scale, every minute. The intra- and inter-rater agreement was verified, receiving kappa values of 0.9 and 0.8, respectively. Finally, the mean of the scores was calculated for each FLACC category in a single session, and the scores for the three categories were totaled to obtain one final score per child, per session.

Statistical Analysis

The data were tabulated in such a way as to organize them in a database containing the following variables: dependent – score of the child's pain during treatment under sedation following the FLACC scale, considering the 3 categories separately as well as their sum; independent – age of the child (in months), sex of the child (female/male), history of dental treatment (yes/no), history of local anesthesia (yes/no) and oral condition of the child (index of dental caries, extracted/extraction indicated, filled – dmf-t).

The data were analyzed using the IBM SPSS v.17 software, significance level at 5%, with non-parametric bivariate analysis because the dependent variable presented non-normal distribution (Shapiro-Wilk test, P<0.05). The size of the effect for the strength of the association was calculated using the Mann-Whitney analysis.

RESULT

Among the 27 children, most were male (n=18, 66.7%), reported a history of past dental treatment (n=24, 88.9%) and had already received local dental anesthesia (n=15, 55.6%). The age of the children ranged from 3.8 to 6.8 years (median 4.8, first quartile 4.4 – third quartile 5.4). The dmf-t index ranged from 2 to 19 (median 8, first quartile 5 – third quartile 11).

Among the children participating in the present study, 14 (51.8%) had no pain during treatment under sedation (FLACC=0). Low to moderate pain scores were observed in the means of the categories of the FLACC scale and in the total sum of the scores in the three categories (Figure 1).

There was no statistically significant association between pain (FLACC) and sex, history of dental treatment or of dental anesthesia (Table 2). Furthermore, the size of the effect was small. The FLACC scores did not correlate significantly with the age of the child (Spearman rho= -0.08; P=0.67) or with the experience of caries (dmf-t index) (Spearman rho= -0.04, P=0.84).

DISCUSSION

This was an exploratory study in which the factors associated with pain in children undergoing restorative dental treatment under moderate sedation were assessed. The pain was assessed using

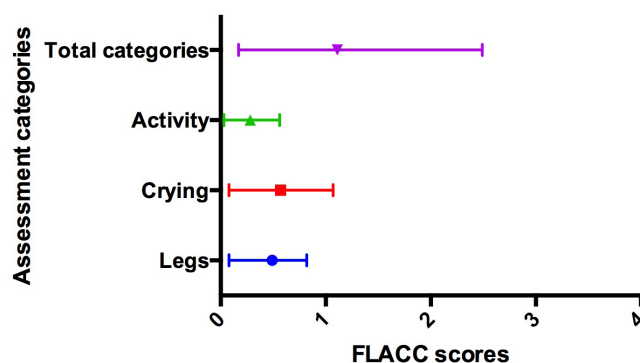


Figure 1. Pain during restorative procedure performed under sedation according to FLACC scale scores.

Table 1. Description of the components of the FLACC scale^{8,18,19}

Categories	Points		
	0	1	2
Face	No specific expression or smile	Occasional grimacing or frowning, introversion, lack of interest	Frequent trembling chin, clenched jaws
Legs	Normal or relaxed	Restless, agitated, tense	Kicking or extended
Activity	Still, in the normal position, moving easily	Squirming, moving back and forth, tense	Curved, rigid or abrupt movements
Crying	No crying (awake or asleep)	Moaning or whimpering, occasional complaint	Continuous crying, screaming or sobbing, frequent complaining
Consolability	Satisfied, relaxed	Reassured by touches, hugs or casual conversation, can be distracted	Difficult to console or comfort

Table 2. Results of the bivariate analysis for the association among the FLACC scale scores and the independent variables sex of the child, previous history of dental treatment and dental anesthesia

Variables	Total FLACC scores			P	Size of the effect (r)
	/ Median	/Minimum	/Maximum		
Sex				0.38	-0.13
Female	2.1	0	3.8		
Male	1.1	0	3.8		
History of dental treatment				0.32	-0.02
Yes	1.2	0	3.8		
No	2.1	0	2.9		
History of dental anesthesia				0.96	-0.09
Yes	1.1	0	3.7		
No	1.9	0	3.8		

Mann-Whitney Test.

the FLACC scale, modified by removing the categories “face” and “Consolability”. The removal of these categories may have led to underestimation of pain, since facial expression is a reliable indicator of pain in children^{19,20} and may have affected the significance of the association among the variables studied.

The scores of the FLACC scale did not differ significantly among the children according to sex and age. According to a review published in 2009, the differences in relation to pain between boys and girls become evident at the onset of puberty²¹. Since the children who participated in the present study are between four and six years old, this fact would explain the observed result. This result also agrees with a recent review in which it was concluded that there is still no evidence about the differences between female and male sexes in the perception of pain²². Meanwhile, the fact that age is not associated with pain may be explained by the low variability in the age of the children included in the study, and the possible similarity in prior experiences of pain.

The memory of prior painful procedures has been associated with pain in subsequent procedures^{13,14}. In the present study, the children with prior history of dental treatment had higher FLACC scores. However, no statistical significance was seen. There was also no significant difference in pain between children that had received dental anesthesia and those who had not. This lack of statistical significance may be explained by the small sample size and by the fact that most of the children had gone to the dentist and received dental anesthesia, making it difficult to observe significant differences with those who had not gone to the dentist or received anesthesia.

The present study has limitations such as the lack of assessment of children’s faces and the small sample size. However, noting the scarcity of evidence regarding factors associated with pain during the dental treatment of sedated patients, the results obtained here should be considered and should encourage the development of studies with larger samples as well as other designs that allow the comparison of sedated and non-sedated children and other forms of pain assessment, including self-reporting among older children.

CONCLUSION

It is concluded that the group of children studied showed little pain during dental treatment under sedation. Also, that this symptom was not associated with age, sex, oral condition and previous dental experience.

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REFERENCES

1. Versloot J, Craig KD. The communication of pain in paediatric dentistry. *Eur Arch Paediatr Dent*. 2009 Jun;10(2):61-6. <http://dx.doi.org/10.1007/BF03321601>. PMID:19627668.
2. Chang J, Versloot J, Fashler SR, McCrystal KN, Craig KD. Pain assessment in children: validity of facial expression items in observational pain scales. *Clin J Pain*. 2015 Mar;31(3):189-97. <http://dx.doi.org/10.1097/AJP.000000000000103>. PMID:24810648.
3. Stanford EA, Chambers CT, Craig KD. A normative analysis of the development of pain-related vocabulary in children. *Pain*. 2005 Mar;114(1-2):278-84. <http://dx.doi.org/10.1016/j.pain.2004.12.029>. PMID:15733654.

4. Hesselgard K, Larsson S, Romner B, Strömlad LG, Reinstrup P. Validity and reliability of the behavioural observational pain scale for postoperative pain measurement in children 1-7 years of age. *Pediatr Crit Care Med*. 2007 Mar;8(2):102-8. <http://dx.doi.org/10.1097/01.PCC.0000257098.32268.AA>. PMID:17273124.
5. Versloot J, Hall-Scullin E, Veerkamp JS, Freeman R. Dental Discomfort questionnaire: its use with children with a learning disability. *Spec Care Dentist*. 2008 Jul-Aug;28(4):140-4. <http://dx.doi.org/10.1111/j.1754-4505.2008.00032.x>. PMID:18647374.
6. Gall O, Champigneulle B, Schweitzer B, Deram T, Maupain O, Montmayeur Verchere J, et al. Postoperative pain assessment in children: a pilot study of the usefulness of the analgesia nociception index. *Br J Anaesth*. 2015 Dec;115(6):890-5. <http://dx.doi.org/10.1093/bja/aev361>. PMID:26582849.
7. Stevens B. Development and testing of a pediatric pain management sheet. *Pediatr Nurs*. 1990 Nov-Dec;16(6):543-8. PMID:2082269.
8. Merkel SI, Voepel-Lewis T, Shayevitz JR, Malviya S. The FLACC: A behavioral scale for scoring postoperative pain in young children. *Pediatr Nurs*. 1997 May-Jun;23(3):293-7. PMID:9220806.
9. Çalış AS, Cagiran E, Efeoglu C, Ak AT, Koca H. Lidocaine versus mepivacaine in sedated pediatric dental patients: randomized, prospective clinical study. *J Clin Pediatr Dent*. 2014;39(1):74-8. <http://dx.doi.org/10.17796/jcpd.39.1.g12782873611827u>. PMID:25631731.
10. Elbay M, Şermet Elbay Ü, Yıldırım S, Uğurluel C, Kaya C, Baydemir C. Comparison of injection pain caused by the DentalVibe Injection System versus a traditional syringe for inferior alveolar nerve block anaesthesia in paediatric patients. *Eur J Paediatr Dent*. 2015 Jun;16(2):123-8. PMID:26147818.
11. Bohari MR, Chunawalla YK, Ahmed BM. Clinical evaluation of caries removal in primary teeth using conventional, chemomechanical and laser technique: an in vivo study. *J Contemp Dent Pract*. 2012 Jan;13(1):40-7. <http://dx.doi.org/10.5005/jp-journals-10024-1093>. PMID:22430692.
12. Pala SP, Nuvvula S, Kamatham R. Expression of pain and distress in children during dental extractions through drawings as a projective measure: a clinical study. *World J Clin Pediatr*. 2016 Feb 8;5(1):102-11. <http://dx.doi.org/10.5409/wjcp.v5.i1.102>. PMID: 26862509.
13. von Baeyer CL, Marche TA, Rocha EM, Salmon K. Children's memory for pain: overview and implications for practice. *J Pain*. 2004 Jun;5(5):241-9. <http://dx.doi.org/10.1016/j.jpain.2004.05.001>. PMID:15219255.
14. Chen E, Zeltzer LK, Craske MG, Katz ER. Children's memories for painful cancer treatment procedures: implications for distress. *Child Dev*. 2000 Jul-Aug;71(4):933-47. <http://dx.doi.org/10.1111/1467-8624.00200>. PMID:11016557.
15. Lourenço-Matharu L, Ashley PF, Furness S. Sedation of children undergoing dental treatment. *Cochrane Database Syst Rev*. 2012 Mar;(3):CD003877. <http://dx.doi.org/10.1002/14651858.CD003877.pub4>. PMID:22419289.
16. Zahid MF. Methods of reducing pain during bone marrow biopsy: a narrative review. *Ann Palliat Med*. 2015 Oct;4(4):184-93. <http://dx.doi.org/10.3978/j.issn.2224-5820.2015.09.02>. PMID:26541397.
17. American Academy of Pediatric Dentistry – AAPD. Clinical Affairs Committee-Behavior Management Subcommittee. American Academy of Pediatric Dentistry. Guideline on behavior guidance for the pediatric dental patient. 2015 Sep-Oct;37(5):57-70. PMID: 26531077.
18. Silva FC, Thuler LCS. Cross-cultural adaptation and translation of two pain assessment tools in children and adolescents. *J Pediatr*. 2008 Jul-Aug;84(4):344-9. <http://dx.doi.org/10.1590/S0021-75572008000400010>.
19. Malviya S, Voepel-Lewis T, Burke C, Merkel S, Tait AR. The revised FLACC observational pain tool: improved reliability and validity for pain assessment in children with cognitive impairment. *Paediatr Anaesth*. 2006 Mar;16(3):258-65. <http://dx.doi.org/10.1111/j.1460-9592.2005.01773.x>. PMID:16490089.
20. Crosta QR, Ward TM, Walker AJ, Peters LM. A review of pain measures for hospitalized children with cognitive impairment. *J Spec Pediatr Nurs*. 2014 Apr;19(2):109-18. <http://dx.doi.org/10.1111/jspn.12069>. PMID:24612473.
21. Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL 3rd. Sex, gender, and pain: a review of recent clinical and experimental findings. *J Pain*. 2009 May;10(5):447-85. <http://dx.doi.org/10.1016/j.jpain.2008.12.001>. PMID:19411059.
22. Bartley EJ, Fillingim RB. Sex differences in pain: a brief review of clinical and experimental findings. *Br J Anaesth*. 2013 Jul;111(1):52-8. <http://dx.doi.org/10.1093/bja/aet127>. PMID:23794645.

CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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