Original Research
Pediatric Dentistry

Impact of dental caries on oral health-related quality of life in children with dental behavior management problems

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Declaration of Interests: The authors certify that they have no commercial or associative interest that represents a conflict of interest in connection with the manuscript.

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https://doi.org/10.1590/1807-3107bor-2022.vol36.0041

Submitted: Mar 23, 2021
Accepted for publication: November 3, 2021
Last revision: December 10, 2021

Abstract: The aim of this cross-sectional study was to evaluate the impact of dental caries and sociodemographic factors on the oral health-related quality of life (OHRQoL) of children with dental behavior management problems (DBMP) and their families. One hundred and thirty-four dyads of caregivers and children participated. The impact of OHRQoL was assessed using the Brazilian version of the Early Childhood Oral Health Impact Scale (ECOHIS). Socioeconomic variables were obtained from an interview. Dental caries was assessed using the dmft index. The total B-ECOHIS score was categorized as low, medium, or high impact, and its association with the independent variables was determined based on bivariate tests and a multivariate model. The median score for B-ECOHIS was 13 (range: 1–40). The negative impact was reflected mainly by complaints of oral/dental pain, difficulty in eating and parental guilt. The number of teeth with caries was significantly higher among children who experienced a high negative impact on OHRQoL (mean 9.2 [standard deviation 3.5]; p = 0.003) than those who had a low negative impact (7.0 [3.3]). The final adjusted model showed that dental caries remained independently associated with poor OHRQoL (b = 0.100; x^2 Wald 4.205; p = 0.040). A greater impact on OHRQoL was experienced by children with DBMP and greater caries experience.

Keywords: Child Behavior; Quality of Life; Dental Caries; Dental Anxiety.

Introduction

More than 600 million children have dental caries worldwide, and most lesions are not treated.[1] Among children up to 5 years of age, a greater caries experience may be the result of postponing dental appointments, because the children cannot and/or do not want to show up, perhaps motivated by dental fear.[2] When consultations are postponed or caries lesions are not treated, the child's oral health tends to worsen over time, thus making invasive and extensive procedures even more necessary. These procedures require greater collaboration from the child who may not be cooperating out of fear and/or aggravated anxiety.[3]

Dental caries negatively affects the oral health-related quality of life (OHRQoL) of children and their families.[4] The presence of at least one decayed tooth has a high negative impact on OHRQoL,[4] and this impact can be observed from the complaints of tooth pain, functional limitations, and anxiety by parents/caregivers.[5,6] This perception of the negative impact of oral conditions on quality of life is influenced by different factors, including the social context of the respondents[7] and the nature/state of the child, characterized by the level of dental anxiety and dental fear.[8-10]

Dental anxiety is one of the main factors associated with dental behavior management problems (DBMP)[11] that can negatively impact OHRQoL. In a study carried out with children aged 5 to 8 years in the United Kingdom, anxious children were found to have worse oral health, observed by greater caries experience, active lesions, and signs of infection. The families of these children experienced a negative impact on quality of life.[10] Other studies confirm this association between children aged 5 years and older and schoolchildren.[8-10]

Knowing that behavioral problems tend to be more frequent among younger children, it is important to investigate the negative impact on OHRQoL in this specific population. Studies with specific population subsets are very useful for increasing the participation and representativeness of certain relevant groups,[12,13] such as that of children with DBMP. Greater knowledge of this specific group of children allows better quantification of the negative impact of oral problems, and encourages the use of this information in developing strategies that can improve access to health services, decision-making procedures, the prioritizing of care, and the minimizing of damage.

Therefore, the objective of this study was to investigate the impact of dental caries on the OHRQoL of preschool children with DBMP.

Methodology

This study was reported following the STROBE guidelines.[14]

Ethical issues

This cross-sectional study was carried out in accordance with Resolution 466/2012, and was approved by the Human Research Ethics Committee of the Universidade Federal de Goiás, Brazil (CAAE: 36411214.1.0000.5083 and 65277317.2.0000.5083). Parents/caregivers received information regarding the objectives of this study, and signed a statement of informed consent. All the participants' rights were protected.

Study design, participants and setting

This cross-sectional study involved the analysis of a secondary outcome of randomized clinical trials held to assess the efficacy of sedatives for the behavior management of children under dental treatment (NCT02447289 / 03290625). The participants consisted of 134 dyads of parents/caregivers and preschool children (up to 5 years old) seen in the sedation outpatient clinic of the Núcleo de Estudos em Sedação Odontológica (NESO) (Dental Sedation Studies Center), School of Dentistry, Universidade Federal de Goiás, Brazil. Participants were evaluated in the period from 2015 to 2019.

The sample size was not estimated for this outcome. The number of participants was calculated based on clinical trials, and the main parameter was the behavior of children under sedation during dental treatment (clinical trials 1: n = 84; 2: n = 88).

To participate in this study, the preschool children had to have a history of DBMP (uncooperative behavior) in previous visits, according to the reports of parents/caregivers, carious lesions in need of restorative treatment, pulp therapy or extraction in at least one tooth, and no systemic diseases (based on the reports of parents/caregivers and a medical examination performed by a pediatrician or anesthesiologist). Parents/caregivers had to live with the child most of the time, and be able to understand the researcher's speech in Portuguese.

The child's behavior was doubled checked in a dental visit consisting of professional prophylaxis and clinical examination to confirm eligibility. Experienced pediatric dentists performed these procedures. At the end of the exam, the child's behavior was classified according to the Frankl scale as: definitely

positive, positive, negative or definitely negative.[15] When definitely negative or negative behavior was observed, the child was included in the study, and treated under sedation. Cooperative children were referred for treatment without sedation. The Frankl scale is routinely used at NESO to assess a child's behavior. A pediatric dentist assisted by another dentist reach a joint decision regarding the Frankl score, despite formal calibration.

Variables and data source measurement

The outcome variable was the impact on OHRQoL. Independent variables were dental caries, the child's sex, age and familial characteristics. Data were collected according to the following steps: interview with the main caregivers (parent or other) and children's oral examination. Parents/caregivers gave an interview in which they provided information about the child's sex and age, maternal education (years of schooling) and monthly family income (in Brazilian reais). For the purpose of statistical analysis, maternal education was categorized at the 8-year cutoff point. This measure corresponds to the basic level of schooling in Brazil, and has been adopted in previous studies.[16,17]

The impact of oral condition on the OHRQoL was assessed with the Brazilian version of the Early Childhood Oral Health Impact Scale (B-ECOHIS).[18] This instrument is composed of 13 questions divided into child impact and family impact sections. Each question has the following choice of answer: never [0], hardly ever [1], occasionally [2], often [3], very often [4] and do not know [5]. The total score for the questionnaire ranges from 0 to 52, with higher scores indicating greater negative impact on OHRQoL. When the respondents answered, "I don't know," or did not answer any questions, the item was considered lost. In cases where up to two questions in the child impact section and one question in the family impact section were lost, the mean of the remaining items in that section was used to impute values for the items that had been lost.[19] However, when more than two questions in the child impact section and one question in the family impact section were left unanswered the questionnaire was excluded from the analysis.[19]

In this study, the impact on OHRQoL was analyzed as an ordinal variable. The categorization consisted of determining two cut points with an equal number of cases in each bin, using IBM SPSS 25.0 visual binning. Thus, three categories of negative impact on OHRQoL were generated: low, medium and high.

In the child impact section, the child underwent an oral examination to assess his or her dental caries experience. Prophylaxis was performed with a Robinson brush and prophylactic paste, in low rotation, prior to visual inspection of the teeth. For the purpose of the exam, the teeth were dried and evaluated using the dmft index (decayed, missing and filled primary teeth),[20] and the number of decayed, extracted and restored teeth was added to the caries experience.

Bias

In cases where the companion was not the main caregiver – the one who spent the most time with the child – the dyad was excluded. Since it was important to ensure that only non-collaborating children would remain in the study, the child's behavior had to be confirmed in a consultation performed by dentists experienced in working with these children.

Statistical methods

Data analysis was performed using the Statistical Package for Social Sciences (SPSS for Windows, version 25.0, SPSS, Chicago, USA). This analysis involved a description of the frequencies and central tendencies of the variables, bivariate tests (chi-square, Kruskal-Wallis and ANOVA tests), and multivariate analysis (ordinal regression). Variables with a p-value ≤ 0.20 in the bivariate analysis were selected to compose the multivariate model. Independent variables were selected for the final model, only if they had a p value < 0.05 after adjustment.

Results

One hundred and thirty-four pairs of children (mean age 41.2 months [standard deviation 12.5 months]; 52.2% boys) participated in the study. The median score for B-ECOHIS was 13 (minimum 1, maximum 40). Children had at least 1 and at most

17 teeth with caries experience (mean 8.0; standard deviation 3.6). The sociodemographic and clinical characteristics of the participants are shown in Table 1. The response rate for the maternal schooling and monthly income variables was 99.2% and 96.2%, respectively, because some participants did not respond. The response rate for the other variables was 100%.

In the child impact section, the items with the lowest frequency of "never" responses were oral/dental pain (26.1%), difficulty in eating (28.4%) and being irritable or frustrated (22.4%). In the family impact section, the items with the lowest frequency of "never" responses were "felt guilty" (17.2%) and "being upset" (39.6%). The item referring to missing school or daycare had the highest rate of loss and need for data imputation (n = 38).

The bivariate analysis indicated that the mean number of teeth with caries experience was significantly higher among children whose caries experience had a high negative impact on OHRQoL (mean 9.2 [standard deviation 3.5]) versus a caries experience with a low impact (7.0 [3.3]; p = 0.003). On the other hand, the caries experience was similar when comparing children whose caries had medium (8.0 [3.8]; p = 0.110) and high impact, and those whose caries had low and medium impact (p = 0.220). There was no statistically significant association between the categories of negative impact on OHRQoL and the independent variables of sex (p = 0.096) or age (p = 0.050) of the child, maternal education (p = 0.107) or monthly family income (p = 0.133) (Table 2).

The final adjusted model showed that the caries experience remained independently associated with poor OHRQoL (b = 0.100; x^2 Wald 4.205; p = 0.040). As the number of teeth with caries experience increases, the likelihood of obtaining worse levels of OHRQoL also increases (higher order categories) (Table 3).

Table 1. Characteristics of the study participants.

Variable	Descriptive data
Children	
Sex (n= 134)	n (%)
Male	70 (52.2)
Female	64 (47.8)
Age (n= 134); mean (standard deviation)	41.2 (12.5)
Family (sociodemographic variables)	
Maternal schooling n= 133†	
≤ 8 years	47 (37.3)
> 8 years	79 (62.7)
Monthly income (Brazilian real) n = 129; median (minimum-maximum)*	1500 (500-5000)
Oral health	
Caries experience n= 134; mean (standard deviation)	8.0 (3.6)
Oral health-related quality of life n= 134	
Impact on child section; median (minimum-maximum)	9.0 (0-31)
Impact on family section; median (minimum-maximum)	4.0 (0-11)
Overall questionnaire; median (minimum-maximum)	13.0 (1-40)
Impact categories on OHRQoL n = 134	
Low	47 (35.1)
Medium	44 (32.8)
High	43 (32.1)

*When the sum of the participants did not total 134, this resulted in no answer.

Table 2. Association between categories of the negative impact of OHRQoL and independent variables.

Variable	Negative impact on OHRQoL			p-value
	Low	Medium	High	
Sex n (%)				0.096*
Male	20 (42.6)	22 (50.0)	28 (65.1)	
Female	27 (57.4)	22 (50.0)	15 (34.9)	
Age (mean; standard deviation)	38.7 (10.8)	40.3 (13.1)	44.9 (13.0)	0.050**
Maternal schooling n (%)				0.107*
> 8 years	26 (57.8)	31 (75.6)	22 (55.0)	
≤ 8 years	19 (42.2)	10 (24.4)	18 (45.0)	
Monthly income (median; minimum–maximum)	1750 (500–3500)	1750 (800–5000)	1200 (500–4000)	0.133**
Caries experience (mean; standard deviation)	7.0 (3.3)[a]	8.0 (3.8)[a,b]	9.2 (3.5)[b]	0.015***

*Chi-square test;**Kruskal-Wallis test; ***ANOVA test, followed by Student's t test. Same superscript letters indicate that there is no statistically significant difference between categories; different letters indicate that there is a statistically significant difference between the categories; p-value for the comparison between low and high: 0.003 (test t); bold value indicates statistical significance.

Table 3. Unadjusted and adjusted regression models for variables associated with impact on OHRQoL in children and their families

Independent variable*	Estimate	p-value	95%CI	Estimate	p-value	95%CI
Sex						
Male	0.683	0.034	0.051–1.316	0.606	0.072	
Female	Reference			Reference		
Age in months	0.030	0.023	0.004–0.055	0.022	0.121	-0.006–0.049
Maternal schooling						
> 8 years	-0.056	0.869	-0.719–0.608	0.130	0.714	-0.567–0.828
≤ 8 years	Reference			Reference		
Caries experience	0.125	0.006	0.036–0.213	0.100	0.040	0.004–0.195

*Monthly income was not inserted in the model due to the collinearity with maternal schooling.

Discussion

In this study, we assessed the impact of dental caries on the OHRQoL in relation to children with DBMP, and this association with sociodemographic factors. In general, the negative experience of the children and their families negatively impacted OHRQoL. A comparison between the negative impact scores for the child, family and total sections of the questionnaire and the results obtained in population studies[5,21] revealed that higher values were observed for children diagnosed as uncooperative.

The present findings are supported by the vicious cycle of dental anxiety. DBMP are often associated with dental fear and anxiety; 61.3% of the children with DBMP are assessed with higher scores for fear than other factors.[22] Fear tends to make children uncooperative during treatment, and this complicates the procedures. The result is the worsening of their oral health status, and the intensification of their dental anxiety.[2] Thus, children with dental anxiety and/or DBMP tend to visit the dentist less frequently, and may have aggravated carious lesions,[22,23] resulting in oral symptoms, such as pain and/or difficulty performing routine activities like eating.

The negative impact of the children's oral condition was mainly reflected by complaints of oral/dental pain, irritation/frustration and trouble eating. Pain and difficulty eating are correlated, and children who experience pain usually have greater difficulty eating as well (data not shown).[24] Having difficulty eating may serve to indicate the severity of a child's

oral condition.[24,25] In the present study, all children had at least one decayed tooth in need of treatment, in addition to a history of unsuccessful attempts at undergoing treatment in earlier visits. Thus, complaints related to pain and functional limitations were expected to be frequent. Difficulty eating, together with a toothache, can cause the child to become irritated. Thus, these complaints of difficulty eating and pain seem to be interconnected, hence explaining why there are so frequent.

Over 80% of caregivers have felt guilty at some point because of problems concerning their children's teeth or treatment. This guilt is manifested especially when they realize that they are responsible for maintaining the child's health, and recognize that they have not acted in the most appropriate way to ensure the child's oral health, and prevent the development and worsening of carious lesions.[26] In this study, the high frequency of caregiver guilt is also believed to be related to the impossible task of treating their children using only basic behavior management techniques. Basic techniques are more accepted by caregivers than pharmacological techniques.[27,28] This preference for using a technique that was not efficient for their child can generate greater guilt and a feeling of helplessness when dealing with the worsening of carious lesions, DBMP and the need for dental treatment under sedation.

A greater negative impact was observed among children with a greater caries experience. This result is in line with that observed in a systematic review conducted with 29 articles that evaluated the association between dental caries and OHRQoL.[4] According to this review, the presence of a decayed tooth is enough to negatively impact the quality of life of children and their families; when a greater number of teeth are affected, the negative impact observed is even greater. [4]

All children who participated in our study had at least one tooth with a caries experience that had a negative impact on OHRQoL – the B-ECOHIS score ranged between 1 and 40. Bearing in mind that the impact of caries on OHRQoL was a common characteristic of all participants, we chose to categorize the B-ECOHIS scores to establish categories that would indicate different severities of this negative impact. This categorization made it possible to compare the severity of the impact on OHRQoL, especially among children with different numbers of teeth with caries experience, emphasizing that more severe oral conditions (many teeth with caries experience) may be associated with the worsening of the child's quality of life, and that of his or her family.

In this study, the number of decayed, extracted and restored primary teeth was combined to determine the dental caries experience. That is, the teeth that had already been treated were counted together with those with caries, so that not just the impact of teeth requiring treatment could be assessed. This methodology is in accordance with that of previous studies[4] that investigated the impact of caries on the quality of life related to the oral health of children. We understand that untreated lesions may have had a greater impact at the time of data collection. However, we cannot disregard that parents/caregivers are instructed to consider the child's entire lifespan, from birth to the moment of evaluation, when they answer the B-ECOHIS.[18] Thus, we could actually be measuring the impact caused by all the lesions, regardless of whether they are still untreated, or by the tooth has been restored or extracted.

The B-ECOHIS allows caregivers to assess the impact of oral condition on the quality of life of the child and their family. This measure replaces the child's report, and can lead to under- or overestimation of what a child would perceive. However, in view of the underdeveloped cognitive capacity of young children, caregivers are the respondents of choice to report outcomes related to the child's health.[5,19] Living with the child during most of the day was a criterion evaluated for the inclusion of caregivers in the study. This criterion minimized the possibility that the respondent did not know the negative interference of dental caries in the life of the child and family.

The fact that all participants were children with DBMP is also a limitation of this study. Conversely, the inclusion of a group of clinically cooperative children would have made it possible to measure whether there is less impact of caries on OHRQoL among these children, or greater impact among uncooperative ones. This is a suggestion for future

studies. Another limitation is the high rate of loss using the B-ECOHIS instrument, related to the impact of absences from preschool or school. In 38 cases, the children did not attend preschool or school, leading to a loss rate of 26.9%. In Brazil, basic schooling is mandatory as of 4 years old, and only 34.2% of the children from zero to 3 years old attend daycare.[29] This information explains the high loss of answers to this question, especially among caregivers of younger children. The missing data was imputed to minimize this limitation.

The impact of oral condition on the OHRQoL of children with DBMP is still a topic rarely addressed in the literature. In most studies conducted with these children, the objective is to assess the change in OHRQoL after treatments have been administered under sedation and/or general anesthesia.[30] In view of the negative impact of DBMP on quality of life, and its possible worsening due to the postponement of treatment, minimally invasive measures can be recommended to treat these children, together with basic and advanced behavior management techniques. When measures are proposed and implemented to prioritize the treatment of these children, this treatment is expected to go beyond just reducing the negative impact on OHRQoL, and positively affect its relationship with the dental environment.

Conclusion

In conclusion, this study revealed that children with DBMP and a greater caries experience feel this impact on OHRQoL more strongly. Pediatric dentists should be aware that these children may have an extensive need for treatment, and that their OHRQoL may be severely impacted. Moreover, professionals should be willing and prepared to give them support, so that they can receive comfortable dental treatment and have their needs met.

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