Original Article
Oral health outcomes: the association of clinical and socio-dental indicators to evaluate traumatic dental injury profile in low income Brazilian children

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Abstract: Objective: To use clinical and socio-dental indicators to evaluate traumatic dental injury (TDI) profile in Brazilian preschool children with low income. Methods: A cross-sectional study was carried out with children of low-income families, from 2 to 6 year-old, who attended public preschools. A clinical indicator to evaluate TDI and a socio-dental indicator to detect the impact on Oral Health-Related Quality of Life (OHRQoL) for preschoolers (Early Childhood Impact Scale - ECOHIS) were used. Impact means were obtained, and the chi-square test and odds ratio were used in order to evaluate the variables (P<0.05). Results: Of the 606 children evaluated, the results were obtained from a final sample of 446 children. The prevalence of TDI was 17%. Children from 37 to 60 months (P=0.04; OR=0.59 95% CI 0.34-1.01) were associated with TDI. The mean impact on OHRQoL in the group with or without TDI was low without a statistical difference (P=0.97). Conclusion: Based on these findings, the association of clinical and socio-dental indicators showed low prevalence of TDI and the impact on OHRQoL was indifferent between groups with or without TDI.

Keywords: Children, traumatic dental injury, quality of life, oral health, economic status

Introduction

Knowledge about the oral epidemiological aspects in a specific population is extremely important for planning public policies as well as to measure the patients' quality of life [1]. The oral health status of children is often related to social dimensions, such as income and parental schooling level [2]. Furthermore, childhood circumstances as indicated by socio-economic status and parent/family structure/quality can influence psychological and psychosocial attributes in children [3].

In public health research traumatic dental injury (TDI) is considered an oral problem due to high frequency [4]. In preschool age it also common and is a special condition because of its behavioral characteristics of curiosity and restlessness associated with lack of motor maturity to prevent falls and promote self-protection [5-9].

The loss of the teeth due to TDI in children can lead to a negative impact on Oral Health-Related Quality of Life (OHRQoL). Thus, TDI's impact involves not only physical and aesthetic damage, but psychological damage as well [10]. In preschool children, TDI acquires a special characteristic due to the child's lack of maturity and cooperation during dental treatment, combined with the emotional and psychological impact of TDI on parents and children themselves [11].

The approach for treating a child with TDI should be taken in a holistic manner to control not only the local injury to the dentition, but also the impact on child's OHRQoL. Treatment of the disease's signs and symptoms alone does not allow a patient to enjoy full health [12]. It is important to examine socio-dental indicators to integrate the data collected from clinical indicators. There is evidence of the limited use of only clinical markers to determine treatment needs

[13]. Thus, this study aimed to use clinical and socio-dental indicators to evaluate TDI profile in Brazilian preschool children of low-income families. The null hypothesis was that there would be low prevalence of TDI and no impact on OHRQoL of Brazilian low-income preschool children.

Materials and methods

Ethical considerations

The Local Human Ethics Committee issued ethical approval for conducting the research (protocol n#68539). The explanation for the parents was carried out by sending a letter with the purpose of the research. Before the children were recruited for the research, informed and written consent was signed by the parents.

Study design and sampling

This cross-sectional study was carried out according to strobe checklist [14] in the city of Nova Friburgo, State of Rio de Janeiro, Brazil, that has 182,082 inhabitants and occupies an area of 933,414 km^2 divided into 8 districts. The predominance of the population is urban (87%). There are 10,331 children from 0 to 4 year-old and 11,850 from 5 to 9 year-old. Of these children, 2,231 from 2 to 6 year-old attended public preschools and were included in the sample of the population with low income for one year.

After signing the informed consent by the parents, the following inclusion criteria were applied: age (2 to 6 year-old); deciduous dentition; low socioeconomic status; parents who speak fluent Brazilian Portuguese. For exclusion, the following criteria were used: children with systemic disease or special needs (i.e. syndromes or motor and mental disabilities), and those who were undergoing orthodontic treatment and did not allow clinical dental examination.

The sample size was calculated to give a standard error of 3%, a design effect of 1.2 with a 95% confidence interval. The prevalence of oral impact due to the oral conditions on preschool children's OHRQoL considering a representative sample was set at 69.3% [15]. The 25% increase in the sample was carried out in order

to compensate for any loss. The minimum sample size was estimated at 408 children. To ensure representativeness in relation to the original population base, children were randomly selected, and grouped depending on the age and school location (urban and rural areas).

Data collection

Sample characterization: Sociodemographic characteristics were collected through a questionnaire sent to the parents/legal guardians of each child who met the inclusion criteria. The questionnaire gathered information on the following sample characteristics: i) children's and parents' gender, age, and skin color; ii) socioeconomic status evaluated based on the possession of specific items by the families, and the educational level of the householder, according to the Brazil Economic Classification Criteria [16]; iii) parents' level of education, was assessed in years of schooling and categorized by the number of years of schooling in two levels: up to 8 years or more than 9 years of schooling; iv) location of children's home/daycare centers (urban or rural).

Socio-dental indicator application: The Brazilian and validated version of Early Childhood Impact Scale (ECOHIS) was used as a socio-dental indicator [17]. ECOHIS was used to assess the child's and family OHRQoL. It presents 13 items divided in two sections: child an family. The child section is constituted by nine items: symptoms (1 item), function (4 items), psychological (2 items) and self-image/social interaction (2 items). The family section contains 4 items: parental distress (2 items) and family function (2 items). The possible answers to the question are: 0=never; 1=hardly ever; 2=occasionally; 3=often; 4=very often. The sum of the response codes generates a total score of ECOHIS and individual scores for each domain. The instrument's score can vary between 0 and 52 points. A higher number of points obtained in ECOHIS indicates greater impact and/or more problems, which is, a worse OHRQoL.

First, a pre-test study was conducted using the questionnaire to assess OHRQoL. New convenience samples of parents/caregivers of children were recruited from daycare centers (n=19). For the test-retest reliability analysis, in the two moments of evaluatin with the questionnaire the conditions of the participants

must remain stable. The second questionnaire was applied, two weeks later. The questionnaires were self-completed by the parents.

The original instrument to detect the OHRQoL (ECOHIS) was tested to children from 2 to 5 years. Once we included the age of 6, we assessed psycometric properties. To assess the psychometric properties of the socio-dental indicators, Cronbach's Alpha and the intraclass correlation coefficient (ICC) were used to assess internal consistency and test-retest reliability, respectively. A satisfactory reliability was detect (Cronbach's Alpha=0.80; ICC=0.94).

Clinical indicator application: The clinical exam was carried out in preschool, with the child lying on the table and the examiner seated, using spatula, disposable gloves, gauze, and lighting under a flashlight. The World Health Organization dental trauma index was used as follow [18]: 0=No sign of injury; 1=Treated injury; 2=Enamel fracture only; 3=Enamel and dentine fracture; 4=Pulp involvement (including teeth with color change); 5=Missing tooth due to trauma; 6=Other damage (including teeth with displacement); 9=Excluded tooth.

Two previously calibrated examiners, specialists in pediatric dentistry, performed the child's clinical examination. Through different images of clinical situations, the training exercise for dental trauma was performed. Calibration was performed with 30 children aged 2 to 6 year-old (not part of the study population) through a clinical examination, on two separate occasions, with an interval of 2 weeks. Intra-examiner (kappa=0. 80) and inter-examiner (kappa=1.00) reliability was assessed.

Data analysis

The Statistical Package for Social Sciences (version 16.0; SPSS Inc., Chicago, IL, USA) was used for statistical analysis. The significance was set at P<0.05.

The frequency of TDI characteristics was obtained regarding prevalence, type of TDI, TDI group and affected teeth. For data analysis, the sample was dichotomized in groups with TDI and without TDI. Mean age and frequency analysis of exploring variables (caregivers' level of education, economic classification criteria, chi-

ld's age group, gender, race, nursery location, and treatment assessment) were obtained. The relation of clinical indicators and these variables were assessed using the student's t-test, chi-square test, and odds ratio.

For the initial exploratory analysis, the frequency distribution for the individual items of the socio-dental indicator (ECOHIS) was determined, and the association of these items with the clinical indicator was obtained using the chi-square test.

To verify the normal distribution of values, the Kolmorogov-Smirnov test was used. The normality of the sample was confirmed. Since the items were scored using the ordinal scale, parametric statistical procedures (student's t-test) were used to compare the means of the total scores and subscale scores. The sample was also dichotomized into a group without impact (ECOHIS=0) and a group with impact (ECOHIS≥1). To assess the association of these groups with the exploratory variables, as well as between the group with and without TDI, chi square test and odds ratio were used.

Results

Sample and TDI characterization

From 2,231 preschool children registered in the public school system; 606 patients were evaluated to participate in this study but 531 met the inclusion criteria. From these, some parents (N=85) did not answered the social and quality of life questionnaires. Thus, the final sample was composed of 446 children and their family. It was considered a 84% positive response rate (**Figure 1**).

The prevalence of TDI was 17%, of which 65.4% and 11.8% presented, respectively, enamel fracture and enamel/dentin fracture (**Table 1**).

Exploratory variables association between presence/absence of TDI

All included subjects were characterized as low income once 100% belong to Brazilian criteria of classification C, D or E. Children from 37 to 60 months (P=0.04; OR=0.59 95% CI 0.34-1.01) and caregivers with more than 9 years of schooling (P=0.03; OR=0.57 95% CI 0.33-0.99) were associated with TDI (**Table 2**).
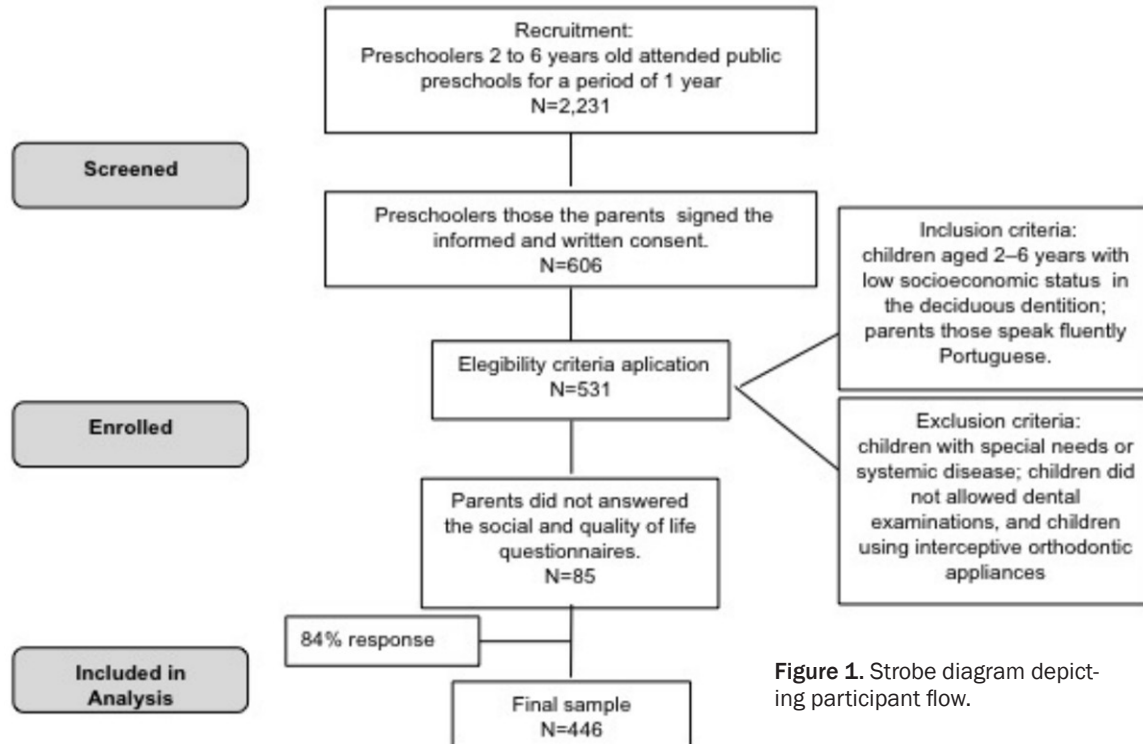
Figure 1. Strobe diagram depicting participant flow.

Table 1. TDI characterization

Variable	N	%
TDI (n=446)		
Yes	76	17.0
No	370	83.0
Type of TDI (n=101)		
Enamel fracture only	66	65.4
Enamel and dentin fracture	12	11.8
Pulp involvement	2	2.0
Missing tooth due to trauma	1	1.0
Other damage (including teeth with color change or displacement)	20	19.8
Type of teeth affected (n=101)		
Maxillary central incisor	90	89.1
Maxillary lateral incisor	8	7.9
Mandibular central incisor	3	3.0

Socio-dental indicator (ECOHIS) and clinical indicator (TDI)

There was no statistically significant difference when assessing the relationship between each item of the socio-dental indicator (ECOHIS) and the clinical indicator according to the TDI Group (**Table 3**). Considering the negative impact on OHRQoL, the ECOHIS scores of total scale and subscales (child and family) did not present an association with TDI (**Table 4**). The association between absence or presence of impact with

exploratory variables did not present a statistically significant difference (**Table 5**).

Discussion

Studies about the prevalence of TDI are important in screening the oral health of a pediatric population. Based on the dental trauma data, it is possible to plan and create oral health strategies mainly for populations with low socioeconomic status [19]. In this study, the null hypothesis was confirmed. It was observed that the

Table 2. Exploratory variables association between presence/absence of TDI

Variables	Total (n=446)	Children with TDI (n=76)	Children without TDI (n=370)	Odds Ratio (95% CI)	P-value
Caregivers					
Years of study** (%)					
≤8	217 (51.1)	29 (39.7)	188 (53.4)	0.57 (0.33-0.99)	**0.03**
≥9	208 (48.9)	44 (60.3)	164 (46.6)		
Preschoolers		With TDI (n=76)	Without TDI (n=370)	Odds Ratio (95% CI)	P-value
Mean age* (SD)	3.63 (1.2)	3.86 (1.1)	3.58 (1.2)	-	0.08
Age** (%)					
24 to 36 months	212 (47.5)	28 (36.8)	184 (49.7)	0.59 (0.34-1.01)	**0.04**
37 to 60 months	234 (52.5)	48 (63.2)	186 (50.3)		
Gender** (%)					
Female	222 (49.8)	39 (51.3)	183 (49.5)	1.06 (0.71-1.60)	0.76
Male	224 (50.2)	37 (48.7)	187 (50.5)		
Ethnicity** (%)					
Caucasian	313 (70.2)	53 (69.7)	260 (70.3)	0.97 (0.55-1.73)	0.92
Afro-descendent	133 (29.8)	23 (30. 3)	110 (29.7)		
Nursery location** (%)					
Rural	101 (22.6)	11 (14.5)	90 (24.3)	0.58 (0.32-1.05)	0.06
Urban	345 (77.4)	65 (85.5)	280 (75.7)		
Treatment assessment** (%)					
No	289 (64.8)	47 (61.8)	242 (65.4)	0.86 (0.50-1.47)	0.55
Yes	157 (35.2)	29 (38.2)	128 (34.6)		

Student's t-test*; Chi-square test**; bold indicated statistical significance. P<0.05.

association of clinical and socio-dental indicator showed a low prevalence of TDI and its condition did not impact negatively on the OHRQoL in children with low socioeconomic status.

The low prevalence among children may have been due to underreporting of the cases, especially those of supporting tissues. In epidemiological studies as presented in this article, the findings are those observed by the examiner. Despite studies have postulated that luxations are more frequent in the primary dentition due to bone resilience and porous characteristics at this stage of dentition [9], cross-sectional studies about TDI prevalence registered cases that trauma sequels are still present. Based on it, the most frequent trauma observed was small dental fractures.

Dental trauma is associated with other factors that must also be detected as a basis of guidance for implementing preventive and educational measures for public health. Determinant variables such as age, gender, ethnicity, caregivers' years of schooling, nursery location, and treatment assessment should be evaluated. In the present study, children older than 37 months and parents with a higher education level were associated with higher incidence of TDI.

Our findings do not corroborate with the literature [9]. Curiosity and restlessness, two behavioral characteristics of children, especially 0 to 3 year-old, in conjunction with lack of sufficient motor maturity to prevent falls and promote self-protection, are the main reasons for dental trauma in children on this age [9].

It was expected that parents with a higher level of education would have increased awareness, however, as reported in other studies, TDI knowledge and perception is low regardless of education. Although there was no statistical association, a low demand for care was observed regardless the child's TDI status. This fact can be attributed to the low importance given to trauma in primary teeth, as the lay population believes that temporary teeth do not require the same attention as permanent ones. However, even for permanent teeth, the majority of schoolchildren evaluated by Martins et al [20] did not undergo treatment (82.6%) because they believed it was unnecessary (53.2%).

Research to evaluate the use of socio-dental indicators must be carried out to be evaluated together with the data found by the clinical indicators [1]. The limitation of the exclusive use of clinical markers to measure treatment needs

Table 3. Frequency according to each item evaluated in B-ECOHIS socio-dental indicator and association with clinical indicator according to TDI

ECOHIS ITENS	TDI						P-value
	Total (N=446)		Without TDI (370)		With TDI (76)		
	ECOHIS=0	ECOHIS≥1	ECOHIS=0	ECOHIS≥1	ECOHIS=0	ECOHIS≥1	
	N (%)		N (%)		N (%)		
CHILD IMPACTS SECTION							
How often has your child....because of dental problems or dental treatments?							
Child symptoms domain							
1) Had pain in the teeth. mouth or jaws?	335 (75.1)	111 (24.9)	279(75.4)	91 (24.6)	56 (73.7)	20 (26.3)	0.75
Child function domain							
2) Had difficulty drinking hot or cold beverage?	372 (83.4)	74 (16.6)	306 (82.7)	64 (17.3)	66 (86.8)	10 (13.2)	0.37
3) Had difficulty eating some foods?	360 (80.7)	86 (19.3)	295 (79.7)	75 (20.3)	65 (85.5)	11 (14.5)	0.24
4) Had difficulty pronouncing any words?	299 (67.0)	147 (33.0)	244(65.9)	126 (34.1)	55 (72.4)	21 (27.6)	0.27
5) Missed preschool, day care, or school?	307 (68.8)	139 (31.2)	253 (68.4)	117 (31.6)	54 (71.1)	22 (29.0)	0.64
Child psychological domain							
6) Had trouble sleeping?	344 (77.1)	102 (28.9)	283 (76.5)	87 (23.5)	61 (80.3)	15 (19.7)	0.47
7) Been irritable?	285 (63.9)	161 (36.1)	237 (64.1)	133 (35.9)	48 (63.2)	28 (36.8)	0.88
Child self-image/social interaction domain							
8) Avoided smiling or laughing?	403 (90.4)	43 (9.6)	333 (90.0)	37 (10.0)	70 (92.1)	6 (7.9)	0.57
9) Avoided talking?	418 (93.7)	28 (6.3)	346 (93.5)	24 (6.5)	72 (94.7)	4 (5.3)	0.68
Parent distress domain							
10) Been upset?	340 (76.2)	106 (23.8)	282 (76.2)	88 (23.8)	58 (76.3)	18 (23.7)	0.95
11) Felt guilty?	349 (78.3)	97 (21.7)	291 (78.6)	79 (21.4)	58 (76.3)	18 (23.7)	0.65
Family function domain							
12) Taken time off from work?	369 (82.7)	77 (17.3)	307 (83.0)	63 (17.0)	62 (81.6)	14 (18.4)	0.76
13) Had a financial impact on your family?	331 (74.2)	115 (25.8)	278 (75.1)	92 (24.9)	53 (69.7)	23 (30.3)	0.32

Chi-square test; bold indicated statistical significance. P<0.05.

Table 4. Mean, standard deviation, and median of ECOHIS socio-dental indicator scores, according to clinical indicator (TDI)

| Socio dental indicator SCALE/SUBSCALE/DOMAIN (VARIATION) | Clinical indicator | | P value |
| | With TDI | Without TDI | |
	Mean (SD)	Mean (SD)	
TOTAL ECOHIS SCORE (0-52)	5.56 (6.06)	5.59 (6.03)	0.97
CHILD SUBSCALE (0-36)	3.30 (3.55)	3.81 (4.06)	0.30
Symptoms domain (0-4)	0.50 (0.87)	0.44 (0.84)	0.61
Function domain (0-16)	1.53 (1.95)	1.91 (2.15)	0.15
Psychological domain (0-8)	1.02 (1.40)	1.18 (1.67)	0.44
Self-image/social interaction domain (0-8)	0.23 (0.97)	0.26 (0.83)	0.77
FAMILY SUBSCALE (0-16)	2.26 (3.23)	1.77 (2.86)	0.18
Parental distress domain (0-8)	1.03 (1.83)	0.91 (1.65)	0.57
Family function domain (0-8)	1.22 (1.90)	0.85 (1.53)	0.12

Student's t-test; bold indicated statistical significance. P<0.05.

are exposed in the literature [13]. For an efficient approach to treating children with oral conditions, it is essential that the consequences of the conditions be evaluated in regards to their effect on the child's OHRQoL [9]. To treat only signs and symptoms of the disease does not allow the individual to make a full recovery.

On the other hand, if the regulatory requirements set by the clinician are not in accordance with the impact reported by the patient, the question should be raised if such patients should be considered for treatment since there was no perceived impact on their daily activities. This implies a reduction in cost to the public health system.

Since there is no specific instrument for assessing this oral condition in the literature, we can use instruments aimed at assessing the OHRQoL in children, paying special attention to those already validated in the Portuguese language [12]. The socio-dental instrument used in this study to detect impact on OHRQoL to complement the clinical indicator of dental trauma was the ECOHIS. This instrument had been previ-

Table 5. Association between ECOHIS scores=0 and ECOHIS scores>0 and exploratory variables

Variables	Total (N=446)	ECOHIS=0 (N=129)	ECOHIS>0 (N=317)	Odds Ratio (95% CI)	P-value
Caregivers					
Years of study** (%)					
≤9	217 (48.7)	71 (55)	146 (46.1)	1.54 (0.98-2.41)	**0.04**
≥10	208 (46.6)	50 (38.8)	158 (49.8)		
No answer	21 (4.7)	8 (6.2)	13 (4.1)	-	
Preschoolers		B-ECOHIS=0 (N=129)	B-ECOHIS>0 (N=317)	Odds Ratio (95% CI)	P-value
Mean age (SD)				-	
Age** (%)					
24 to 36 months	212 (47.5)	67 (51.9)	145 (45.7)	1.28 (0.83-1.97)	0.23
37 to 60 months	234 (52.5)	62 (48.1)	172 (54.3)		
Gender** (%)					
Female	222 (49.8)	68 (52.7)	154 (48.6)	1.18 (0.77-1.82)	0.42
Male	224 (50.2)	61 (47.3)	163 (51.4)		
Ethnicity** (%)					
Caucasian	313 (70.2)	86 (66.7)	227 (71.6)	0.79 (0.50-1.26)	0.30
Afrodescendant	133 (29.8)	43 (33.3)	90 (28.4)		
Nursery location** (%)					
Rural	101 (22.6)	34 (26.4)	67 (21.2)	1.32 (0.80-2.19)	0.23
Urban	345 (77.4)	95 (73.6)	250 (78.8)		
Treatment assessment** (%)					
No	289 (64.8)	85 (65.9)	204 (64.4)	1.07 (0.68-1.68)	0.75
Yes	157 (35.2)	44 (34.1)	113 (35.6)		
TDI** (%)					
No	370 (83.0)	108 (83.7)	262 (82.6)	1.08 (0.60-1.94)	0.78
Yes	76 (17.0)	21 (16.3)	55 (17.4)		

Student's t-test *; Chi-square test **; bold indicated statistical significance.

ously validated [17] and demonstrated satisfactory psychometric properties in this sample. Hence, it is suggested to use ECOHIS to assess the impact of OHRQoL in Brazilian children suffering from TDI.

Considering the TDI impact, this study was not related to a negative impact on OHRQoL related to oral health of children and their parents with low socioeconomic status. This fact can be attributed to the sample characteristics, as pointed before, which predominantly consists of TDI of small magnitude that may go unnoticed.

The low demand for care associated with low impact observed is a worrying fact. Diagnosis of TDI during childhood has great relevance. The need to raise public awareness of the importance of seeking trauma treatment in primary teeth is emphasized, as future problems may be generated due to this negligence.

Consequences, such as tooth loss and even alterations in permanent tooth successors are observed in long-term follow-ups, which does not seem to be a matter of importance for the general population.

As a policy for this population, a greater focus on information regarding TDI in primary teeth and the impact that they have on present teeth and in subjacent permanent teeth would be necessary. This oral involvement has not generated a high impact on OHRQoL in this population, which probably explains the lack of search for treatment by the patients. Also, being underdiagnosed generates a low demand for care. It is necessary to change the focus of medical and dental treatments towards favoring transdisciplinary approaches, both for children and for their families. This new approach would ensure access to information on the importance of treating dental trauma in primary dentition.

Another possibility for the low impact observed in this population may be due to the high cost of treatment [21, 22]. Data may be underestimated, so many children with mild dental lesions do not seek treatment or receive a precise diagnosis [23].

The results found in this study are representative of the target population: children with low socioeconomic level and enrolled in public early childhood education schools in the city of Nova Friburgo, Rio de Janeiro. It is suggested to apply this method in similar studies, for example, in assessing the impact of trauma on children with higher socioeconomic status in private schools in the city. This would help to confirm or refute these results.

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Disclosure of conflict of interest

None.

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