Oral Health Indices for Epidemiological Surveys: A Comparison in the Saycare Study

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Abstract

Objective: To compare, within the SAYCARE study, the epidemiological indices adopted by the WHO in oral health for dental caries and periodontal disease with others used for the same purpose.

Methods: The oral health of preschoolers, schoolchildren and adolescents from Teresina was evaluated in the SAYCARE pilot project. Caries disease was evaluated by the ICDAS and DMFT indices while for periodontal disease the PSR and CPI indices were used. The diagnostic results of these indices were then compared by means of percentages (descriptive analysis).

Results: In all age groups studied, there was a high prevalence of caries, where the number of white spot lesions was higher than that of dentine caries, according to the ICDAS code. The DMFT index presented worse results than the ICDAS, as the former does not consider white spot lesions or enamel cavitation. A high prevalence of gingival bleeding was also seen, especially among adolescents. Comparisons between PSR and CPI results showed similar diagnostic results.

Conclusion: Analysis of the comparison of the results of the DMFT and ICDAS indices indicates that the latter is more appropriate when describing the prevalence of caries in multicentric studies. However, the CPI index seems to be better suited to the evaluation of periodontal conditions than the PSR.

Keywords: Oral Health Indexes; Dental Caries; Periodontal Disease; Multicentric Study; Methodology

Introduction

Dental caries and periodontal disease (PD) are prevalent oral health problems worldwide whose relationships with other systemic conditions have been studied [1]. The inclusion of oral health assessment in multicentric studies such as the South American Youth/Child Cardiovascular and Environment Health Study (SAYCARE) is innovative. It generates a vital discussion on deciding which indices should be applied, considering not just those advocated by the World Health Organization [2], such as the Decayed, Missing and Filled Teeth (DMFT) and the Community Periodontal Index (CPI), for caries and periodontal disease, respectively, which present certain limitations liable to make the evaluation of more detailed results of longitudinal studies unfeasible, as in the case of SAYCARE, which evaluates other aspects such as diet, obesity, cardiovascular risk and lifestyle.

Through the International Caries Detection and Assessment System (ICDAS), Pitts (2004) [3], pointed out that the DMFT takes into account only those teeth or dental surfaces which present carious lesions extending to the dentin [2], which is verified in several cross-sectional and longitudinal studies [4-7], while disregarding the early stages of the disease. Both DMFT and ICDAS methods use visual or visuo-tactile detection [8,9] of dental carious lesions, but the ICDAS also deals with white spots and initial enamel lesions [3,9]. Consequently, studies comparing caries prevalence using both methods, confirm that the ICDAS presents a higher prevalence of the disease [10,11]. This is significant especially in populations with a low prevalence of dental caries, where carious lesions present low progression rates and are mainly in the early stages [12]. In addition, the ICDAS presents good reliability and validity in both deciduous and permanent dentitions [9,13-15].

The CPI is criticized because its methodology does not examine all teeth, but is confined to specific teeth previously standardized for the examination [2]. Another index arising out of CPI modifications and advocated by the American Dental Association (ADA) and the American Academy of Periodontology [16], is Periodontal Screening and Recording (PSR), which provides more detailed diagnosis because all teeth are examined. It is widely used in both the United States and Canada [17] and can be used in the qualified detection of risk groups and can safely be used even with children [18]. However, there is little discussion in the literature on a comparison between these two indices [17].

As diet and habits can change over time, the DMFT index may not reflect this change, as new enamel lesions and changes in the extent or depth of existing lesions are not evaluated [19,20]. The ICDAS provides information on the stage, severity, and progression of a patient's carious lesions [3,9] and is the ideal index for studies involving other factors such as diet and lifestyle [19-21]. Likewise, the CPI also may not diagnose changes that have occurred, as these may occur in teeth which only indices, such as the PSR examine [17]. This study sets out to compare, within the SAYCARE study, the epidemiological indices, adopted by the WHO, in oral health for dental caries and periodontal disease, the two most prevalent diseases, in both children and adults [1] with other indices used for the same purpose.

Methods

The SAYCARE study

The SAYCARE (South American Youth/Child Cardiovascular and Environment Health Study) proposes to verify unhealthy behavior and lifestyles, with common risk factors and associated with chronic diseases, such as caries, periodontal disease, obesity, cardiovascular and diabetic diseases from childhood onwards, so that preventive measures can be incorporated into health promotion policies. The SAYCARE multicentric study will be carried out in Brazil, in two cities (São Paulo and Teresina), and in five other South America countries (Argentina, Chile, Colombia, Peru and Uruguay). In this first stage in which doctors, dentists, physical educators and nutritionists participated, the pilot project was developed with a view to studying the validity and reliability of the anthropometry tools, oral health, sedentarism and physical activity, blood tests, and the diet questionnaire.

For this research, only oral health data from the pilot project related to data collection in Teresina were used. The institutes involved were the University of São Paulo (Department of Preventive Medicine of FMUSP), the State University of Campinas (Department of Social Dentistry of FOB) and the Federal University of Piauí (Department of Health Sciences), working in partnership with the University of Zaragoza (Spain), internationally known for its experience in multicentric studies in Europe, such as the IDEFICS (Identification and prevention of dietary and lifestyle-induced health effects in children and infants) [22].

Ethical considerations

This research was approved by the Research Ethics Committee of the Faculty of Medicine at the University of São Paulo (FMUSP), on September 17, 2014, registered as research protocol 232/14, entitled: Design and Implementation of the SAYCARE Study: "South Ameri-

can Youth/Child Cardiovascular and Environmental Study", following the guidelines of the National Health Council's resolution 466/12. The study was conducted in schools where the Management Board received a formal request which detailed the importance, objectives and methodology of the study, in order to obtain their consent and collaboration for the project. The ethical considerations, objectives, importance, benefits and risks of the study were explained to the volunteers and/or people responsible who agreed to participate in the study, and who signed a Free and Informed Consent Term (FICT).

Population and study design

In this cross-sectional observational epidemiological study, preschoolers (5 to-6-year-olds), schoolchildren (7 to 12-year-olds) and adolescents (13 to 17-year-olds), regularly enrolled in public and private schools in Teresina, State capital of Piauí, in the Northeast region, were evaluated. The sample size was calculated on the basis of experience in multicentric projects involving children and adolescents with a previous feasibility pilot study [23,24]. This calculation took into consideration the validation of the blood pressure monitor, used as a reference. The sample calculation was carried out to verify reliability and agreement between the mercury column measurement and automatic monitor methods, in the population under study. For this calculation the parameters used were: two-tailed α of 0.05 (type I error), a β or power of 0.10 (type II error), correlation coefficient, Cronbach's alpha (α) of 0.88 and a concordance ratio of 95% [24].

On the basis of these parameters, it was estimated that a sample of 102 individuals in each age group (preschoolers, schoolchildren, and adolescents) from each participating city, including that of this study, Teresina, would be necessary for validation and agreement between the two methods. Predicting a 15% loss and rejection, 60 public school and 60 private school students were invited, which resulted in 120 students per age group for each city invited to participate, totaling 360 subjects per capital. In each city a public and private school for each age group was selected for convenience reasons. Children and adolescents, 50% male and 50% female, in each place were randomly selected from the list of students enrolled. Students who were pregnant or unable to respond to the questionnaire were excluded, as were those whose parents, guardians and/or the individual themselves did not consent. As inclusion criterion, all those selected who presented the FICT signed by their parents/guardians and who were not included in the exclusion criteria, were admitted.

The oral health of Teresina children and adolescents was evaluated by means of a clinical examination and data referring to caries and periodontal disease were recorded, in a standardized SAYCARE form. Oral exams were carried out by dentists who had done the calibration process, using standardized methods. Individual protective equipment was used to prevent cross infection. The results of 2 indices used for caries evaluation, the ICDAS and DMFT, and 2 for evaluation of their periodontal condition, the PSR and CPI, were then compared. Teresina was the only city in the SAYCARE study where the CPI was applied.

Training and calibration of examiners

The training and standardization session took place in Teresina, in March 2015, where 2 examiners, dentistry graduates, participated. They were trained in accordance with the recommendations of the World Health Organization (WHO) [2] and trained and calibrated to use the ICDAS [3], PSR [16] and the Community Periodontal Index (CPI) [2].

The examiners were standardized in accordance with a standard examiner or "Gold Standard", who was highly experienced in examinations with the indices used. In the inter-examiner calibration, the examiners evaluated the same group of subjects and the results were compared to each other. The whole calibration process was planned for a 20-hour workload for each work team. For the theoretical discussion of all indices, codes and criteria, 8 hours were allocated for presentation and discussion with the examiners. In this stage, the e-learning program provided free of charge by the ICDAS Foundation for prior training (www.icdas.org) [25] was used. During the practical discussion (12 hours), each participant examined students who were also examined by the Standard Examiner. The form and the data collection method were applied to a number of non-sampled patients, corresponding to 10% of the total sample. Working along with the "Gold Standard", discrepancies in the clinical findings, diagnostic criteria, codes and registry errors were identified until an

acceptable level of agreement of at least 90% for ICDAS and 80% for PSR and CPI was reached, with the "Gold Standard" and between the other examiners. To calculate these agreements, the Kappa coefficient was used. Kappa values between the examiners ranged from 0.72 to 0.991, with agreement of 96.7% to 98.1% for the ICDAS index, while for the PSR index, the values ranged from 0.68 to 0.96, with agreement of 94.4% to 98.4%.

After this step, the examiners met for another training phase, in which the same indices, codes and criteria used were tested in an intra-examiner calibration, where there was over 75% agreement per examiner for each index. Intra-examiner Kappa values ranged from 0.92 to 0.969, with agreement of 98.4% to 99.5%, for the ICDAS index while for the PSR index, it varied from 0.53 to 0.976, with agreement of 75.4% to 98.4%. The examiners were then considered eligible for participation in the pilot study.

Assessment of caries disease

The ICDAS criteria, which allow for the detection of the disease in its initial stages were used [3]. The examination was carried out after teeth had been brushed. Then relative insulation was used and the teeth were dried for approximately 5 seconds with an air jet from a mini compressor (200 VA, 60 Hz) with the aid of artificial lighting (headlamp, 120 lumens). For all of these exams, a dental diagnostic plane mouth mirror Nº5 and a spherical calibrated periodontal WHO-probe were used, with both examiner and child seated. The clinical stages of the carious lesions were established according to the histological classification proposed by Ekstrand., *et al.* [26] ranging from the identification of a white spot located in fossulae, which would require drying in order to be visualized (code 1), to the visible cavity in dentin (code 6).

The ICDAS criteria were: 0) sound, without caries; 1) first visual change in enamel, visible as a white spot after drying; 2) white spot visible without drying; 3) localized enamel cavitation, without clinical signs of dentinal involvement); 4) dark shadow underlying dentin; 5) cavity visible in dentin, with less than one third of the surface involved; and 6) extensive cavity visible in dentin, with more than one third of the dentin involved. Lesion activity was not evaluated. In the schoolchildren age group, who have mixed dentition, 1 was attributed for lesions in mixed dentition and 2 for those in permanent dentition.

Subsequently, on the basis of these criteria, the results were converted to the DMFT index, considering the ICDAS code 4 as a cutoff point, from which it is considered that there is a lesion in dentin [3,25], a condition required by the DMFT criteria, according to WHO, if a carious lesion is to be registered in the exam [2]. Thus, ICDAS codes 4, 5 and 6 were considered for the DMFT index. Codes 1 and 2, for a white spot, and code 3, for a lesion in the enamel were considered as diagnostic criteria for the ICDAS only. This conversion methodology was successfully used in studies by Elsalhy., *et al.* [20] and Almerich-Silla., *et al* [27]. The results of these two indices were then compared to each other.

Assessment of periodontal disease

The Community Periodontal Index (CPI) [2] and Periodontal Screening and Recording (PSR) [16] were used to evaluate the periodontal conditions. The examination conditions followed the recommendations advocated by the WHO for epidemiological surveys [2]. The periodontal examination was undertaken before the teeth were cleaned, that is, before the evaluation of caries, so that the results would not be affected. A spherical periodontal WHO-probe was used as demanded by both index criteria. The PSR index was first applied followed by the CPI, as the WHO index considers only the following index teeth up to 19 years: numbers 16, 11, 26, 36, 31 and 46. The PSR considers all teeth for the exam.

The mouth was divided into six sextants comprising teeth 17 - 14, 13 - 23, 24 - 27, 37 - 34, 33 - 43 and 44 - 47 and measurements were made by examining the gingival groove of the teeth with the probe in a parallel position to the long axis of each tooth. All teeth, except third molars, were examined in six sites, 3 per vestibular and 3 per lingual, and only the most severe code of the sextant was recorded in an

individual file, according to the codes: 0- Sound sextant, 1- Gingival bleeding, 2- Dental calculus, 3- Shallow periodontal pocket, between 3.5 and 5.5 mm and 4- Deep periodontal pocket, above 5.5mm. In the PSR, these codes can also be accompanied by an asterisk (*), as the insertion of this code (*) in the sextant means there are problems such as furcation involvement, mobility, gingival attachment loss and more than 3.5mm gingival recession. However, in children under 15 years of age, pockets (codes 3 and 4) were not recorded, as soft tissue changes could be associated with eruption and not with pathological periodontal changes. Similarly, the asterisk (*) code was not used because the conditions it represents are not common in that age range. The results obtained from each index were then compared.

Statistical analysis

Descriptive statistics were used to characterize the oral health situation of children and adolescents and to compare the results in percentages, in accordance with the indices used for the diagnosis of caries (ICDAS and DMFT) and periodontal disease (PSR and CPI). Pearson's Chi-square test was applied for comparison of caries prevalence according to the ICDAS and DMFT codes. The data were analyzed using IBM SPSS Statistics version 20. The level of significance was set to 0.05.

Results

The final sample consisted of 312 students, of whom 101 were preschoolers, 100 were schoolchildren and 111 adolescents. In the public schools, there were 55 preschoolers, 57 schoolchildren and 58 adolescents, and in the private schools, there were 46, 43 and 53 respectively. There was a greater than predicted sample loss in private schools, except among adolescents, as many of the children initially qualified for the study refused to undergo the dental exams and were therefore excluded from the sample. The prevalence of caries according to the initial stages of the disease and dentin lesions among students is shown in table 1.

Type of school	Age group	Carious lesions by ICDAS codes						Total carious lesions
		1	2	3	4	5	6	1+2+3+4+5+6
Public schools	Preschoolers	17	37	31	6	103	54	248
	Schoolchildren (1)	1	28	30	7	71	83	220
	Schoolchildren (2)	9	49	25	0	16	26	125
	Adolescents	22	60	38	8	29	46	203
Private schools	Preschoolers	15	44	20	5	30	8	122
	Schoolchildren (1)	7	22	14	3	32	12	90
	Schoolchildren (2)	4	17	12	3	2	1	39
	Adolescents	13	27	21	7	23	22	113

*Table 1: Total dental surfaces with caries lesions, according to the ICDAS index codes, by type of school and age group. Teresina, Piauí, Brazil, 2016.*
Note: As schoolchildren have mixed dentition, 1 refers to deciduous dentition and 2 to permanent dentition.

The percentages of surfaces with carious lesions in students are distributed by school type in graph 1 and 2. The ICDAS index presented better diagnostic results than the DMFT (Graph 3 and 4).
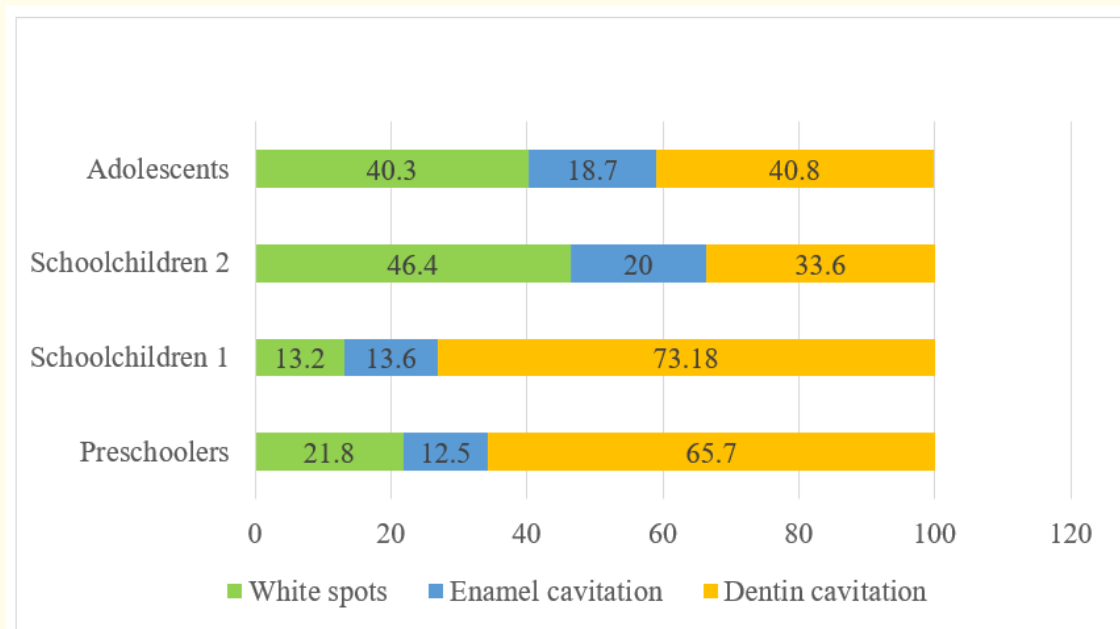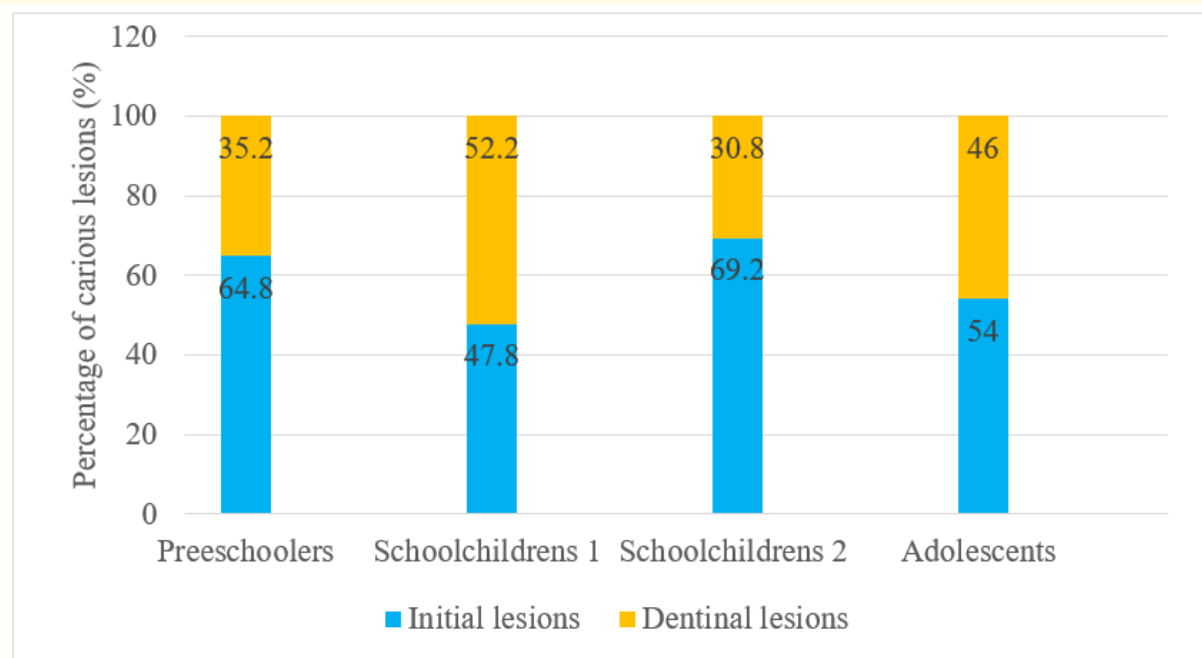

Graph 1: Distribution of percentages of surfaces with carious lesions among public school students. Teresina, Piauí, Brazil, 2016.
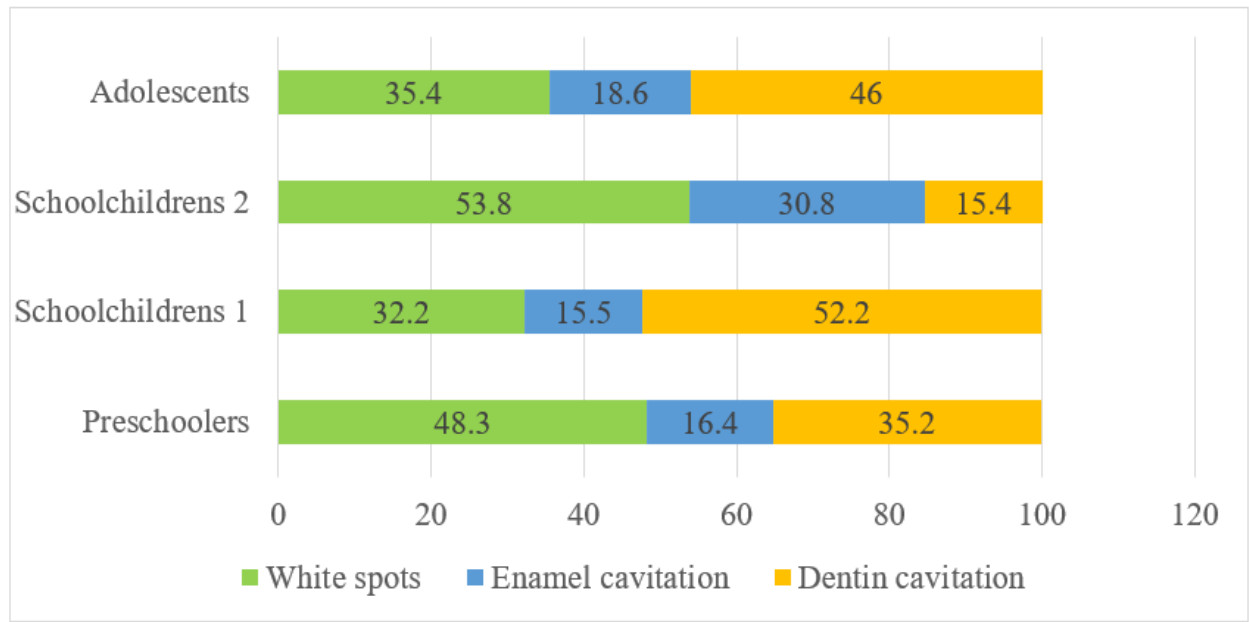
Graph 2: *Distribution of percentages of surfaces with carious lesions among private school students. Teresina, Piauí, Brazil, 2016.*
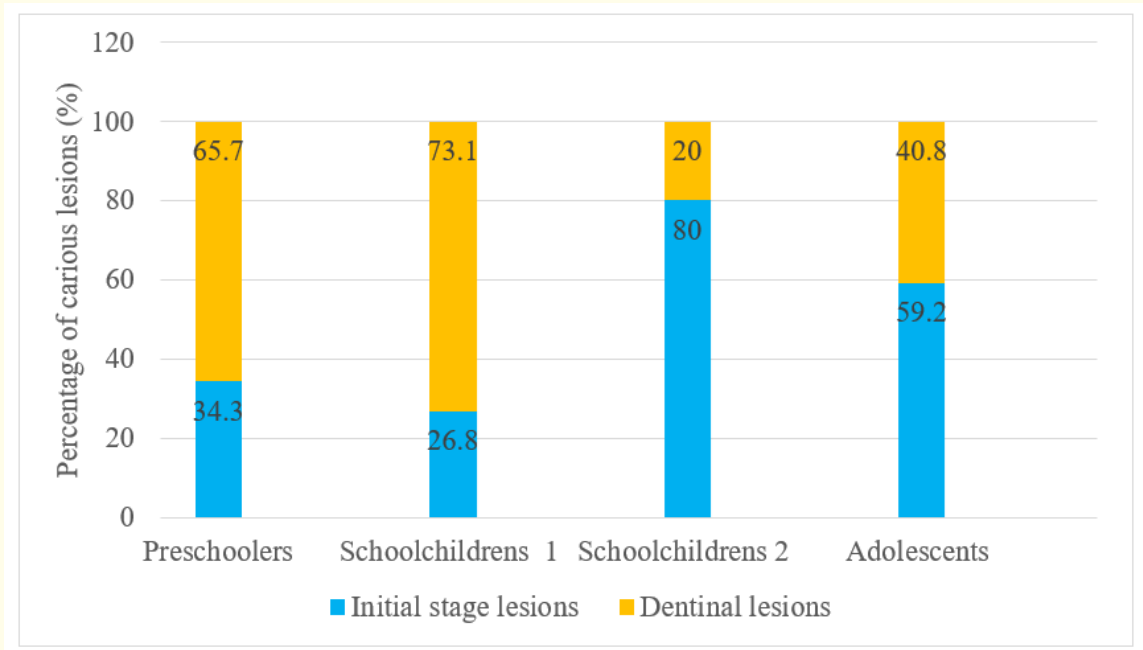
Graph 3: *Comparison of diagnostic results of ICDAS and DMFT indices by public school student.*

Graph 4: *Comparison of diagnostic results of ICDAS and DMFT indices by private school student.*

Among public school preschoolers, schoolchildren and adolescents in Teresina, 55.2% (N = 30), 50.8% (N = 29) and 46.0% (N = 27) of students, respectively, were free of caries according to the DMFT index, when DMFT by dental surface criteria were used. When evaluated by the ICDAS, these percentages were reduced to 48.3% (N = 26), 39.0% (N = 22) and 28.3% (N = 16), respectively.

In private schools, 69.8% (N = 32) of preschoolers, 67.2% (N = 29) of schoolchildren and 51.8% (N = 27) of adolescents were free of caries according to the DMFT index. According to the ICDAS, 54.7% (N = 25), 51.2% (N = 22) and 39.3% (N = 21), respectively, had no carious lesions. Thus, in the public and private schools, in all age groups, the ICDAS index had a higher prevalence of caries (p < 0.001) when compared to DMFT.

Analysis of periodontal condition data in the public schools shows that, according to the CPI index, 29.3% (17) of the preschoolers, 49.2% (29) of the schoolchildren and 41.7% (25) of adolescents presented bleeding. In the private schools, the prevalence of bleeding was also the most common condition, with 15.1% (8) in preschoolers, 39.7% (23) in schoolchildren and 41.1% (23) in adolescents. When the PSR was applied, the prevalence of bleeding increased among the private school schoolchildren and adolescents, rising to 44.8% (26) and 46.4% (26), respectively (Table 2).

The prevalence of periodontal disease, represented mainly by gingival bleeding and calculus in the age groups studied, presented very similar results with the two indices, according to table 2 and 3, despite the fact that the PSR showed a higher prevalence in certain sextants. As for the periodontal pockets of 3 to 5 mm, there was only one divergence among public school adolescents. According to the CPI, sextant 4 had one single pocket, while there were two pockets when the PSR was applied.

School and Age group	Sextants											
	1		2		3		4		5		6	
	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR
Public Schools												
Preschoolers	29.3% (17)	29.3% (17)	13.8% (8)	13.8% (8)	29.3% (17)	29.3% (17)	29.3% (17)	29.3% (17)	8.6% (5)	8.6% (5)	24.1% (14)	25.9% (15)
Schoolchildren	52.5% (31)	55.9% (33)	25.4% (15)	27.1% (16)	55.9% (33)	55.9% (33)	49.2% (29)	49.2% (29)	23.7% (14)	25.4% (15)	40.7% (24)	47.5% (28)
Adolescents	40.0% (24)	40.0% (24)	31.7% (19)	33.3% (20)	33.3% (20)	41.7% (25)	41.7% (25)	41.7% (25)	20.0% (12)	26.7% (16)	38.3% (23)	40.0% (24)
Private Schools												
Preschoolers	13.2% (7)	13.2% (7)	11.3% (6)	11.3% (6)	15.1% (8)	17.0% (9)	15.1% (8)	15.1% (8)	7.5% (4)	9.4% (5)	17.0% (9)	18.9% (10)
Schoolchildren	48.3% (28)	48.3% (28)	22.4% (13)	22.4% (13)	36.2% (21)	37.9% (22)	39.7% (23)	44.8% (26)	19% (11)	19% (11)	37.9% (22)	39.7% (23)
Adolescents	39.3% (22)	41.1% (23)	42.9% (24)	42.9% (24)	37.5% (21)	39.3% (22)	41.1% (23)	46.4% (26)	33.9% (19)	33.9% (19)	41.1% (23)	46.4% (26)

Table 2: Prevalence of gingival bleeding by sextant, according to CPI and PSR indices. Teresina, Piauí, Brazil, 2016.

School and Age groups	Sextants											
	1		2		3		4		5		6	
	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR
Public Schools												
Preschoolers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7% (1)	1.7% (1)	0.0%	0.0%
Schoolchildren	0.0%	0.0%	0.0%	0.0%	0.0%	1.7% (1)	0.0%	0.0%	5.1% (3)	5.1% (3)	0.0%	0.0%
Adolescents	8.3% (5)	15% (9)	1.7% (1)	1.7% (1)	11.7% (7)	11.7% (7)	6.7% (4)	8.3% (5)	11.7% (7)	11.7% (7)	3.3% (2)	10.0% (6)
Private Schools												
Preschoolers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Schoolchildren	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.3% (6)	10.3% (6)	0.0%	0.0%
Adolescents	1.8% (1)	1.8% (1)	1.8% (1)	1.8% (1)	0.0%	5.4% (3)	0.0%	0.0%	5.4% (3)	5.4% (3)	0.0%	0.0%

Table 3: Prevalence of gingival calculus by sextant, according to CPI and PSR indices. Teresina, Piauí, Brazil, 2016.

Discussion

In epidemiological surveys, the WHO and World Dental Federation (FDI) have been recommending for decades the DMFT index for caries diagnosis and the CPI index for the evaluation of periodontal disease [2,28]. However, these indices are currently being questioned

in terms of their methodology, criteria and sensitivity [3,16]. In this study, we verified that the recent ICDAS index presents higher diagnostic results of caries than those of the DMFT. However, the results provided by the CPI and PSR indices were very similar. This discussion is significant, especially during the decision-making process on the methodologies to be used in multicentric studies such as SAYCARE.

As regards DMFT, one of the main reasons these institutions alleged for its persistent use is greater ease of comparison with the results of other epidemiological studies, as it is renowned among researchers and in the world's scientific literature [2,28]. However, these studies minimize the need for the prevention of caries disease [3,7]. Based on visual criteria, the ICDAS system was also developed for the standardized collection of data on caries in different situations and allows for a better comparison between studies, as it can be compared with other indices, including the DMFT itself, because their codes can be dismembered [3,9]. In addition, the ICDAS allows for the planning of preventive treatment, interception or monitoring of carious lesions at individual and population levels [29,30].

In terms of difficulties, certain authors cite the fact that, in addition to the material commonly used in traditional epidemiological surveys, a mobile compressor with an air syringe for drying teeth and the visual aid of an artificial head light are needed to use ICDAS, all of which increases the time needed and cost of research [27]. However, the feasibility and validity of this index in epidemiology has been the subject of numerous publications [13-15,31]. Other authors state that when the ICDAS is used the results of data collection are superior in quality, with greater detail of caries epidemiology and that this should be considered more important than the difficulties described above [32,33].

In the studies which opted for the ICDAS, there is a clear tendency towards an increase in enamel lesions, whether white spots or cavitations, represented by codes 1 to 3, which reflects a higher prevalence of caries at the enamel level than at the dentin level [11,21,34,35], as was also seen in Teresina. There was an increase in caries prevalence in all age groups in this study with the ICDAS index, which also occurred in studies by Joseph., *et al.* [36] (France) and Aidara and Borgeous [10] (Senegal), which reported increases of 28.2% and 43%, respectively, in the prevalence of caries using the ICDAS method, when compared with that of the WHO. Mendes., *et al.* [37] report that most children classified as "caries-free" according to the WHO criteria show carious lesions without cavitation and affirm that the caries develops but does not progress in most children, showing that the idea that the prevalence of dental caries has declined worldwide is not true. The progression of caries disease into cavitated lesions with dentinal involvement seems to have decreased [10,36]. It is probably more appropriate to control the factors associated with caries progression than to simply evaluate and treat carious lesions with cavitation [37].

The DMFT index underestimates lesions which do not require any invasive treatment, and contributes to inequalities within a population and even in the individual, because it decreases the total number of carious lesions and their degree of severity [10,36,37]. The number resulting from this assessment does not provide any information about the stage or penetration depth of the lesion, types of restoration or their conditions [5,8]. In other words, the DMFT only provides a number which shows those teeth or surfaces that have carious lesions, teeth which were lost or restored [2]. On first contact, the ICDAS system codes are numerous and challenging, but with training the system becomes logical, efficient and easy to use [39,40]. What the system lacks is just one general evaluation measure on the patient's state of carious disease for all teeth and surfaces, as already exists in the DMFT [39,40].

Interestingly, the data from this study show that there is a pressing need to emphasize oral health care, such as the use of toothbrushes, toothpaste and floss, mouthwashes, and greater access to fluoride and regular dental visits, as also noted by Banava., *et al.* [11] and Guido., *et al* [19]. The first visit to a dentist and the first preventive intervention should be carefully planned and worked on more thoroughly, especially among preschoolers and schoolchildren, as these still depend on parents or guardians to determine their health behavior [38].

Initial lesions are more severe in under 5-year-olds, because these depend on their parents for feeding and doing their oral hygiene [41]. Because diet and habits can change over time, the DMFT index may not reflect this change in the oral environment in the short term,

as new enamel lesions and changes in the lesion depth, likely with a sugar-rich diet, with items, such as soft drinks and other sugary beverages, are excluded [20,42]. That would only be possible with the ICDAS, for reasons already mentioned. Ferraz., *et al.* [21] show that the inclusion of non-cavitated lesions according to the ICDAS II criteria in the diagnosis of dental caries in the sample under study indicated a higher prevalence of caries among obese children, when compared to children of normal weight, and that this did not happen when the DMFT index was used.

On the other hand, the comparison of the results of the CPI and PSR periodontal indices presented an almost unknown reality, as few publications addressing this issue were found in the literature and none using the same methodology. In summary, the diagnoses provided were very similar, which would indicate that the CPI is more suitable for epidemiological surveys according to this descriptive study. This is justified because, as the CPI evaluates only index teeth, the periodontal examination is less time-consuming and less costly and maintains the validity of the data obtained, as argued by Vettore., *et al* [43]. An examination of 6 points in all teeth, advocated by the PSR, involving up to 168 probing sites per mouth, excluding third molars, results in 168 measures for each person, and requires a major effort for epidemiological surveys of multicentric studies, which seems unnecessary according to the results found. However, other studies using the CPI have reported situations where the patients' periodontal health did not reflect the hierarchical distribution of the codes and resulted in erroneous evaluation of the severity of the disease [44,45].

Overweight and obesity could be related to periodontitis, which is the more advanced stage of periodontal disease, as obesity could produce certain effects on systemic health and affect the host's susceptibility to periodontitis due to inflammatory mediators [46]. This connection could have relevant public implications for health, as both diseases are significant risk factors for cardiovascular diseases [47,48].

Multicentric studies require more precise and more sensitive epidemiological diagnoses, if associations with other diseases, such as obesity and cardiovascular diseases, for example, are to be investigated more thoroughly, and result in more effective public policies on the control of common etiological factors. The inclusion of non-cavitated or cavitated enamel lesions in the caries detection system improves the sensitivity of studies, especially in populations with a low prevalence of dental caries, as such lesions present low rates of progression and are mainly found at the early stages [36,37]. The identification of these lesions during their initial stage is a crucial challenge in the diagnostic process, which allows for the control of re-mineralization before going on to form a cavity [49].

Conclusion

Analysis of the comparison of results of the DMFT and ICDAS indices indicates that the latter is more appropriate for describing the prevalence of caries in large epidemiological surveys, such as multicentric studies, especially in the context of prevention and investigation of association with other chronic diseases. However, evaluation of periodontal conditions seems to be more appropriate with the CPI than with the PSR index, whose examination has been shown to be more time-consuming and disadvantageous considering that the diagnostic results of both indices are similar.

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