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Original Article

Caries Diagnosis in the Mixed Dentition Using ICDAS II

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Abstract

Objective: To assess the dental caries prevalence with ICDAS II in the mixed dentition, 40 children aged 7 to 11 years old, participating in a social program, whose parents and/or guardians signed a informed consent form. **Material and Methods:** Clinical examination was carried out after brushing. A single researcher performed the examination and the diagnosis consistency was obtained by Kappa coefficient in 12% of the sample. All dental surfaces were examined receiving a two-digit code. The first one refers to the presence of restoration/sealant and the second, the severity of carious lesions. The data was processed at SPSS software version 10.0 and analyzed using descriptive statistics (absolute distribution, percentage, mean and standard deviation). **Results:** The coefficient intra-examiner agreement was 0,83. Caries prevalence was considered high because 100% of the children had some surface with non-cavitated caries lesion. ICDAS II can be easily transformed to dmf-s or DMF-S without compromising its integrity. For dmf-s/DMF-S decayed surfaces were considered ICDAS codes 3 to 6, resulting in a dmf-s = 6,57 where 11 children (27,5%) presented no decayed deciduous teeth surface. DMF-S = 2,0 showed that 15 children (37,5%) had none decayed permanent surface, determining a underestimation of the caries disease when using dmf-d/dmf-s and DMF-S indexes. **Conclusion:** A careful viewing of initial caries lesions makes ICDAS II usefull in evaluating the health promotion actions impact, supporting the planning process, implementation and evaluation of program activities.

Keywords: Oral Diagnosis; Dental Caries; DMF Index.
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Introduction

Tooth decay or dental caries is a result of a chemical dissolution of the tooth structure caused by metabolic events in the biofilm of the affected area [1]. It is a complex disease, involving several stages; therefore, early identification is required.

In Brazil, considering the epidemiological data from the most recent National Survey on Oral Health – SB 2010 [2], although the DMFT index at 12 years old has fallen from 2.8 to 2.1 in the last 7 years, another rate indicates that 43.5% of caries-free children at this age, reducing it to 23.9% for adolescents between 15 and 19 years old, a fact that reinforces the need to detect tooth decay lesions and allow the implementation of treatment and control measures aiming to prevent an increase in the number of tooth decay lesions along the time. In recent decades, several caries assessment criteria have been developed to identify the presence of this pathology. A review of 29 systems of tooth decay investigation criteria concluded that most of them are ambiguous and does not identify the different stages of the disease process [3].

In 2002, a group of researchers proposed a new detection system: the International Caries Detection and Assessment System (ICDAS), which gathers the best aspects from other systems [4]. It was developed to produce an internationally accepted system, allowing to assess the tooth decay activity and compare data from distinct sites and in different periods. The use of a standardized system would lead to better information quality to support diagnoses, prognoses and tooth decay treatment at both individual and public health levels. In 2005, aiming to publish progress in the ICDAS classification, more professionals gathered and produced the current version of this index, calling it ICDAS II [4].

The codes contained in ICDAS II can identify the first visible change in tooth enamel, from non-cavitated stage of the lesion to an extensive cavity of the tooth decay. They also present a significant correlation of lesion depth with histological extent [5-7], demonstrating excellent reproducibility and accurate diagnosis, in vitro, in the detection of occlusal lesions [7,8] in these various disease stages.

As it detects lesion depth through appearance, ICDAS II can assess the disease severity. In addition, it helps select the treatment [6], reinforcing its potential as a tool to monitor tooth lesion progress along the time [7,9].

A tendency has been observed in global epidemiological studies [10-13] that use the ICDAS II assessment criteria aiming to compare data from different countries. Yet, few studies have been conducted presenting epidemiological data about non-cavitated caries lesion. One of these studies concluded the ICDAS II criteria are simpler than other visual diagnostic systems [14].

In Brazil, some studies have used ICDAS II as a tool to detect caries lesion and activity [10,15-17]. Other studies have used this system to compare caries diagnosis methods in deciduous teeth [18-22] and permanent teeth [23], and some of these are validated methods [24,25]. Some studies have analyzed the reproducibility and accuracy [26] of the methods, and others have identified their role in making decisions about the disease treatment and control [9,23].

The studies mentioned above have combined methodologies when comparing the indexes used in deciduous and permanent teeth. However, there is no evidence of this index in mixed dentition. On the other hand, the literature shows no consensus on the way to adjust ICDAS to the index established by the WHO.

Considering that, the purpose of this study was to describe the caries situation of a group of children, in mixed dentition phase, using the ICDAS II classification. In addition, this study presents a comparison between ICDAS II and dmf/DMFT.

Material and Methods

This study was conducted with 50 participants of a social program, from 7 to 11 years old, who receive medical, dental, nutritional care, as well as additional school support and participate in sports, leisure and cultural activities. They are students from public schools, low-income families, among other characteristics that expose them to risk situations and conditions of social vulnerability. Aiming to help improve the health conditions of children, the dental professionals offer free preventive and surgical-restorative services to participants.

Only children whose parents and/or guardians signed an informed consent term were included in the sample. The exclusion criteria were: non-signature of an informed consent term, absent children on the examination day and children with special needs.

The clinical examination to obtain the ICDAS II index was conducted in a dental office, after teeth cleaning conducted by the dental surgeon. The examination protocol was conducted first with wet teeth and then, relative isolation was made with cotton rolls. Then, the surfaces were dried with air spray for 5 seconds, as established in the ICDAS Manual [4]. The clinical dental mirror and periodontal probe with 0.5 mm ball end from the WHO were used.

The ICDAS II training to the researcher consisted in: ICDAS II criteria manual reading [4]; online class view at the ICDAS Foundation website (27); examination of eight children with two other trained researchers; and discussion of doubtful points until reaching a consensus.

The same researcher conducted all examinations, and the consistency of his diagnosis was obtained via Kappa coefficient in 12% of the sample. All surfaces of every tooth were examined and received a code of two digits, the first related to the presence of sealant/filling and the second referring to carious lesion severity [4]. Data collected were entered in individual records, suggested by the ICDAS Foundation for epidemiological studies.

Data entered in the ICDAS application were restructured and adjusted to the WHO indexes, considering codes 3-6 for decayed tooth, allowing comparisons between both indexes, with subsequent evaluation of treatment needs and creation of proper health programs to fulfill the needs of the population in question.

SPSS for Windows version 10.0 was used in data analysis through descriptive statistics (absolute and percentage distribution, mean values and standard deviation).

This study was approved by the Human Research Ethics Committee from the UCB (Catholic University of Brasilia (nº150/2008).

Results

The intra-examiner coefficient (Kappa index) was 0.83. In total, 40 children were examined, 24 (60%) male and 16 (40%) female children. Regarding their age, the mean value was 9.27 (±1.06) years.

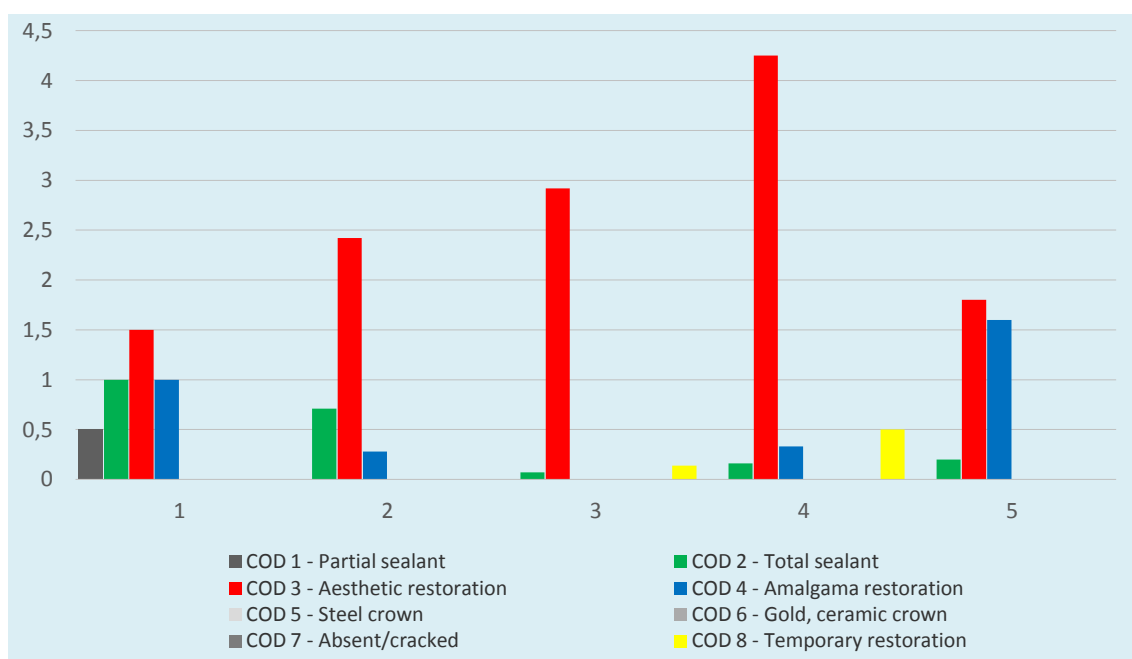Figure 1 shows the distribution of mean teeth surfaces with restoration treatment according to age.

Figure 1. Distribution of mean teeth surfaces with restoration or sealant, according to age, by individual.

Table 2 shows mean surfaces with impact from every caries severity code.

Table 2. Mean surfaces with impact from every caries severity code of ICDAS II by individual.

Code	Mean	Standard deviation
COD1	5.35	3.61
COD2	5.75	4.29
COD3	1.35	1.70
COD4	0.30	0.52
COD5	0.83	1.69
COD6	1,78	3,81

Figure 2 shows the distribution of every caries severity code occurrence, according to age.
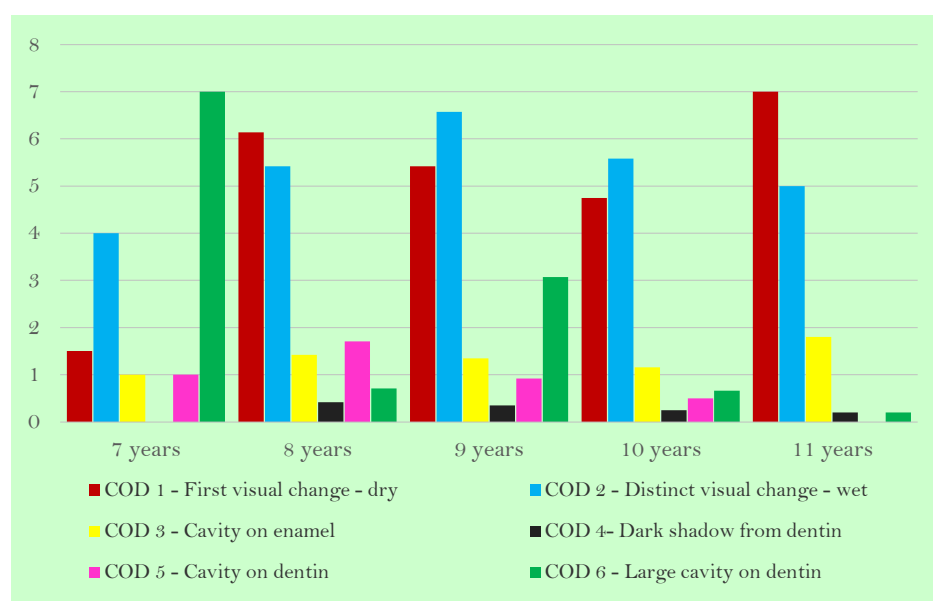
Figure 2. Distribution of mean tooth surfaces with caries lesion according to age

Table 3 shows the distribution of individuals according to the presence of every code.

Individuals	n	%
Individuals without cavity or initial caries lesion (code 0)	0	0.0
Individuals without cavity or with initial caries lesion (codes 1 and 2)	6	15.0
Individuals with cavity (codes 3, 4, 5 and 6)	34	85.0
Total	40	100.0

Table 4 shows the occurrence of every ICDAScode in deciduous and permanent dentition.

Table 4. Absolute frequency distribution of surfaces with impact from caries severity codes of ICDAS II on deciduous teeth and permanent teeth.

Code	Deciduous Teeth		Permanent Teeth	
	n	%	n	%
Code0	1,175	81.1%	2,353	87.6
Code1	53	3.6%	156	5.8
Code2	95	6.5%	138	5.1
Code3	33	2.2%	19	0.7
Code4	8	0.5%	1	0.03
Code5	33	2.2%	10	0.4
Code 6	51	3.5%	9	0.33
Total	1,448	100%	2,686	100

To obtain dmf/DMFT indexes, this study considered decayed surfaces classified as codes 3, 4, 5 and 6 of ICDAS II. Thus, mean dmf index was 1.85 and mean DMFT was 3.81. To calculate the number of caries-free children using the dmf index and the DMFT index, codes 0, 1 and 2 of ICDAS

II were used. When using ICDAS II, caries-free children were those presenting code 0 only, for every dentition, as illustrated in Figure 3.
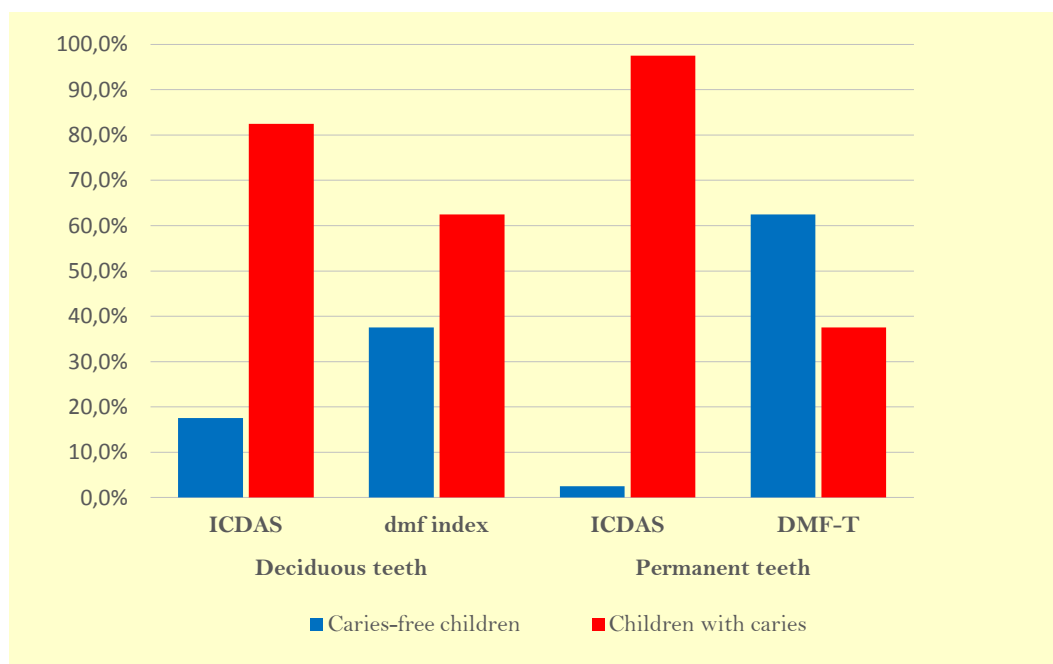

Figure 3. Percentage distribution of caries-free children, according to the ICDAS II criteria and dmf index/DMFT, for every dentition

Discussion

The Kappa index obtained in this study was very good, indicating high level of intra-examiner agreement (0.83), similar to other studies [10,11,15]. That confirms the statement that says ICDAS has good-to-excellent reproducibility, even for raters without experience in epidemiological studies and even after a short training time [7].

The reduced number of restorative procedures already conducted with the sample (Figure 1), when compared to the number of tooth faces with caries (Figure 2), can be explained by the fact that this group of children has no access to dental services. Most of them had their first dental visit after the beginning of social program activities.

The prevalence of caries found in this study is high, as all examined children presented one of more tooth surfaces with enamel caries lesion, findings that are similar to other studies that also used the same index [10,11,13].

Mean occurrences of codes 1 and 2 were the highest (Table 2). Similar results were reported by other authors [29]. Mean occurrence of code 2 was the most prevalent and for code 4, the least prevalent – which is similar to another study also conducted with mixed dentition [11].

As demonstrated in Figure 2, mean surfaces with caries lesion classified as code 1 at 11 years old was higher than for 7-year-old children, reinforcing that an educational/preventive approach is required to protect the permanent teeth as they erupt. On the other hand, a tendency to gradual

reduction in mean surfaces of code 6 (large cavitated lesions) was observed in children between 7 and 11 years old, which can be explained by the exfoliation of deciduous teeth, usually severely decayed in children with no access to dental services, such as the children in the sample. Mean presence of other codes was similar at all ages. It was similar to another study where the prevalence of dentin caries in deciduous dentition was higher than in permanent dentition [10]. However, another investigation did not report any statistical difference in the number of dentin lesions according to age [11].

ICDAS II appeared as a flexible and easy index, but of delicate use. One of its positive characteristics is flexibility, which allows to be easily adjusted to dmf or DMFT indexes, without affecting its integrity. It should be noted that, when obtaining the dmf and DMFT indexes of the studied children, this study considered cavitated surfaces classified as codes 3, 4, 5 or 6 of ICDAS II, as code 3 as cutoff point provides data that can be compared to the WHO criterion [15].

The dmf index obtained from ICDAS II in this study was 6.57, with 11 children (27.5%) not presenting any decayed deciduous tooth surface, when considering the dmf criteria. The DMFT index was 2.0 and, according to this result, 15 children (37.5%) did not present any decayed permanent tooth surface. These results, just like the results of another study [3], showed that traditional caries assessment indexes (DMFT and dmf) underestimate the caries experience for not considering the initial lesion stages. Many children considered as caries-free children according to DMFT and dmf presented non-cavitated caries lesions. Taking ICDAS II as reference, 100% of the sample presented a sign of caries on at least one surface.

Some researchers [10,12,15] also considered codes 3 to 6 as cavitated surface, for the purpose of adjusting to DMFT. Other studies, however, considered codes 4-6 [30], or any code greater than code 0, i.e., cavitated or non-cavitated lesions [15]. Other authors considered code 4 as non-cavitated, so it should not be converted in "D" for the dmf and DMFT indexes [14]. For this reason, researchers should report in their methodology the codes considered when adjusting ICDAS II to dmf or DMFT, to allow data comparison.

Conclusion

In this study, ICDAS II identified high prevalence of non-cavitated lesions in the sample, indicating that an oral health program of educational and preventive character is required. The index applied after adjusted to dmf or DMFT showed that the dmf and DMFT indexes underestimate the tooth decay disease in the studied population. ICDAS II appeared as a flexible and easy index, but of delicate use, requiring short training period.

Acknowledgements

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