

Prevalence of Noncavitated Occlusal Dentine Caries in Students in a City with a Low Prevalence of Caries

Prevalência de Cárie Oclusal Dentinária Não-cavitada em Estudantes de um Município de Baixa Prevalência de Cárie

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ABSTRACT

Purpose: The aim of this study was to determine the prevalence of noncavitated occlusal dentine caries in permanent molars among students in a city with a low prevalence of caries. Combined radiographic and visual examinations were employed. **Methods:** The sample comprehended 1290 occlusal surfaces of permanent molars, in 179 students aged 12-15. The methods used were: visual inspection (VI), visual inspection with previous drying (VID) and Radiographic Examination (RE). For the statistic analysis, the DMFT and the DMFT modified (including RE, early lesions and microcavitated lesions) indexes were used. **Results:** The mean DMFT was 2.3 (sd=2.5), and 32.5% of the students were free from caries on the VI. Of the

918 surfaces scored as clinically sound on VI, 241 demonstrated radiolucency in dentine on RE and the noncavitated occlusal dentine caries prevalence (per individual) was 56.4%. Of the 404 surfaces scored as clinically sound on VID, 75 (18.6%) demonstrated dentine radiolucency and the noncavitated occlusal dentine caries prevalence was 35.5%. Including dentine lesions on RE, the mean DMFT was 3.1 (sd=2.3), and 13.4% of the students were free from caries. **Conclusions:** The radiographic examination is effective in epidemiological surveys. However, new methods to replace this method should be evaluated, because the difficulty of transportation hinders its frequent use.

KEYWORDS: Epidemiology, dental caries, radiography dental.

INTRODUCTION

The DMFT index is the recommended one by WHO to measure and compare the caries experience in populations. Its value expresses the mean of decayed, missed and filled teeth in a group of individuals. In the last years, it has been extensively used to assess dental caries prevalence in surveys and it is accepted in most countries for its versatility¹.

The significant reduction in the prevalence and severity of caries has been accompanied by a change in their pattern and distribution. Current studies have demonstrated that occlusal caries represent the major portion of new caries lesion in the first and second permanent molars, and its detection has become more difficult^{2,3}. The use of fluoride has changed the pattern of the disease, which makes the enamel break itself in a latter stage.

This type of lesion, also known as noncavitated occlusal dentine caries, is described as a lesion that is not clinically diagnosed using the accepted visual-tactile criteria such as cavitation, opacity and change of color, but which is detected only on radiographs as radiolucency lesion in dentine⁴. The prevalence of caries has been reported to range from around 3% to 50% in clinical studies^{2,4,5}, and studies with histological validation have shown that only a small percentage of occlusal caries lesions can be diagnosed by visual and tactile inspection^{6,7}.

This difficulty in the diagnosis has occurred mainly in popu-

lations with a low prevalence of caries⁸, such as in Piracicaba, Brazil, where this study was accomplished, in which the DMFT index was 1.9 in 2004 in children at the age of 12 years old. The city has been supplied with fluoridated water since 1971⁹.

Considering this epidemiological context, methods that could aid in caries diagnosis in surveys were tested. Studies have demonstrated that the conventional radiography plus visual-tactile examination significantly improve the accuracy of occlusal caries diagnosis and is commonly employed in clinical practice. However, these auxiliary resources are not usually used in epidemiological studies in Brazil, where only the visual-tactile examination is used for the diagnosis. This way, the underestimation of these lesions can impair the planning in oral health, allocating less resource than it would be necessary.

The lesions that are not visible or detected by the visual examination, and in which the dentine has been affected, are not detected in their early stage. However, even when in dentine, the caries can be present in different depths and, so measures to promote health can still be applied. This way, methods to detect and quantify these lesions in an early stage are important so that more accurate intervention can be adopted. Therefore, the aim of this study was to assess the noncavitated occlusal dentine caries prevalence in scholars aged 12 to 15 in Piracicaba through visual examination using radiographic examination as an auxiliary method.

METHOD

The approval for the study was obtained from the Human Ethics Committee of Piracicaba Dental School, University of Campinas (Report #067/2003).

Sample

The estimate of the samples was based in the highest prevalence of noncavitated occlusal dentine caries (50%) in accordance with early researches, being added 20% of loss, making a total of 327 schoolchildren aged 12 to 15 years old. These schoolchildren were chosen at random among all the schoolchildren enrolled in 20 public schools in Piracicaba, Brazil, also previously chosen at random. The exclusion criteria of children in this study were children who did not have at least one permanent molar free from caries and who were in orthodontic treatment.

Examiner training and calibration

The examiner training and calibration process happened in daily sections, in a total of 36 hours, with theoretic and practice training. The intraexaminer agreement for the Visual Exam was 0.9 (Kappa). During this process, the consistence of the exams was checked by "gold standard" with the aim of achieving an acceptable level of agreement (Kappa > 0.85).

Visual Inspection (VI) (WHO)

The Visual Inspection was performed by one examiner under natural light, using a dental mirror nº 5 and ball-ended CPTIN probes, indicated for epidemiological surveys of oral health¹⁰.

The indexes used are also recommended by WHO¹⁰. The dental caries were assessed by DMFT index, which consists in the means of decayed, missed and filled teeth.

From the diagnostic performed in this first examination, children that had at least a first or second permanent molar caries free remained in the other stages of the research.

The re-examination was performed in 10% of the children, and the intraexaminer agreement was 0.94 (Kappa).

Visual Inspection with previous drying (VID)

The teeth were cleaned with a toothbrush by the examiner before this examination was performed. After that, each tooth was dried for 5 seconds¹¹ with the use of compressed air and was examined with the aid of a light reflector, both portable equipments. The criteria used were proposed by Nyvad¹² (1999) and adapted for this research as shown in Table 1.

Table 1. Criteria used in the Visual Examination with previous drying. NYVAD, 1999.

Score*	Criteria	Score this study**
0	Sound	0
1	Surface intact, white spot active	1
2	Surface discontinuity active	2
3	Cavity active	3
4	Surface intact, white spot inactive	4
5	Surface discontinuity inactive	5
6	Cavity inactive	6
S	Sealant	S
	Greyish discolouration under sound enamel	A

* Score proposed by Nyvad

** Score used in this study

In the criteria proposed by Nyvad¹² (1999) the score A doesn't exist and it was included in this research to indicate a greyish discolouration dentine under sound enamel after air drying. This criterion was not considered as the presence of noncavitated occlusal dentine caries when individually analyzed, only when there was radiolucency suggesting a lesion after a radiographic examination.

The re-exam in VID was performed in 10% of the children, and the intraexaminer agreement was 0.88 (Kappa).

Radiographic Examination (RE)

The radiographies were taken from the same teeth free from caries selected to the VID. They were taken using a X Prodentol 70 Intra (60 kV, 10 mA, 0,4 s; Prodentol Equip. Odontol., Ribeirão Preto, Brazil), with bitewing positioners (Jon Han'Shin PF 682, Jon Ind., São Paulo, Brazil) and Kodak Ultraspeed (Eastman Kodak Company, Rochester, USA), followed by processing in an automatic processor.

The radiographies were assessed by the same examiner who had performed the previous examinations; however, in different situations, so that the results of the first exam did not influence in the radiographic examination. The assessment was performed under ideal conditions for the radiographic interpretation, under 2x magnification in dark room using a standard radiographic illuminating box and peripheral light block out. The criteria used were proposed by Ekstrand¹³ (1997) as shown in Table 2.

Table 2. Criteria used in the Radiographic Examination. EKSTRAND, 1997.

Score	Criteria
R0	No radiolucency visible
R1	radiolucency visible in the enamel
R2	radiolucency visible in the dentine but restricted to the outer 1/3 of the dentine
R3	radiolucency extending to the middle 1/3 of the dentine
R4	radiolucency in the pulpal 1/3 of the dentine

The re-examination was performed in 10% of the radiographies, and the intra-examiner agreement was 0.61 (Kappa).

Statistic Analysis

For the statistic analysis, the DMFT and the DMFT modified indexes were used. To calculate the DMFT modified index, we added to the DMFT index the cavitated and microcavitated lesions found in the VID, and we also added the noncavitated occlusal dentine caries found in the RE. Data were showed by mean and standard deviation, comparing DMFT results between conventional DMFT and modified DMFT.

RESULT

The consent rate for the examination was 54.7%. As a result, 179 children were examined.

Visual Inspection

The mean of DMFT index was 2.3 (sd=2.5), and 32.5% of children were free from caries according to the WHO.

Of the 1290 occlusal surfaces of permanent molars examined

in the 179 children chosen, 918 (71.2%) were clinically sound, 296 (22.9%) filled and 76 (5.9%) decayed.

Visual Inspection with previous drying (VID)

From this starting point, only the first and second permanent molars considered sound on the VI according the WHO were re-assessed, this means 918 occlusal surfaces. Of those, 90 surfaces were excluded from the analyses because they had orthodontic band or presented microcavitation or cavitation after drying. Therefore, 828 sound occlusal surfaces were assessed with a focus on the greyish discoloration dentine under sound enamel to detect caries.

Of the 828 occlusal surfaces diagnosed as sound on the VI, 404 were sound before VID and 41 (4.9%) demonstrated greyish discoloration under sound enamel. Table 3

Table 3. Comparison of visual examination with previous drying and Radiographic Examination for caries diagnoses.

Visual Examination with drying	Radiographic Examination										
	R0	%	R1	%	R2	%	R3	%	R4	%	TOTAL
Sound (0)	316	78.3	13	3.2	74	18.3	1	0.2	0	0	404
Greyish discoloration under sound enamel (A)	12	32.4	0	0	23	62.2	2	5.4	0	0	37

Radiographic Examination (RE)

Of the 918 occlusal surfaces diagnosed as sound on the visual examination, 129 (14%) were excluded from the radiographic analysis for the same reasons mentioned on the previous examinations, and also for problems related to the radiography itself during its processing, such as distortion and flaw. Therefore, 789 were assessed by radiographic examination.

Of the 789 surfaces analyzed, 523 (66.2%) did not present radiolucency suggesting caries (R0); 25 (3.2%) presented radiolucency in the radiographic examination suggesting enamel caries (R1); 231 (29.3%) presented caries in the outer third of the dentine (R2), and 10 (1.3%) in the medium third (R4), that is, 241 lesions were noncavitated occlusal dentine caries (Figure 1).

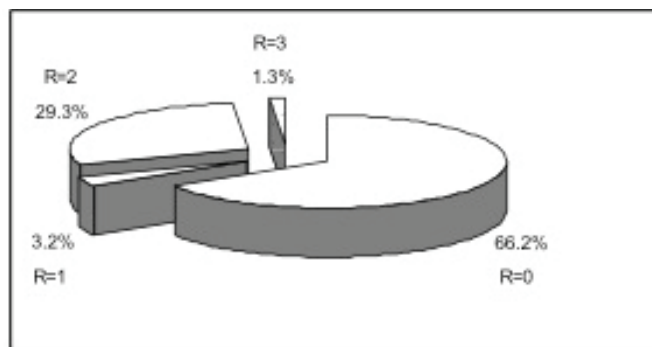


Figure 1: Percentage of sound teeth (R0) and carious lesions (R1, R2 and R3) in the radiographic examination in 789 occlusal surfaces diagnosed as sound on the visual inspection.

When the radiographic images of the 41 surfaces which presented greyish discoloration under sound enamel in the visual examination with drying were analyzed, 4 (9.76%) were excluded for problems related to the radiographies mentioned above. From the 37 remaining surfaces, 25 (67.6%) presented radiolucency in dentine suggesting caries, considering that 2 of them were in the medium third of the dentine, and the others in the outer third; and 12 (32.4%) did not present radiolucency (Table 3).

Considering the results of the radiographic examination, the DMFT, including noncavitated occlusal dentine caries, would be 3.1 (sd=2.3) and 13.4% of the scholars were free from caries. The occlusal caries prevalence considering the individual was 56.4%, with a mean of 1.68 surfaces affected, by adolescent (Figures 2 and 3).

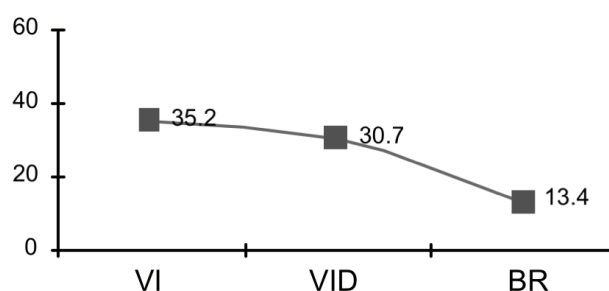


Figure 2: Percentage of scholars free from caries in the Visual Inspection (VI), after the Visual Inspection with drying (VID) and before the Radiographic Examination (RE).

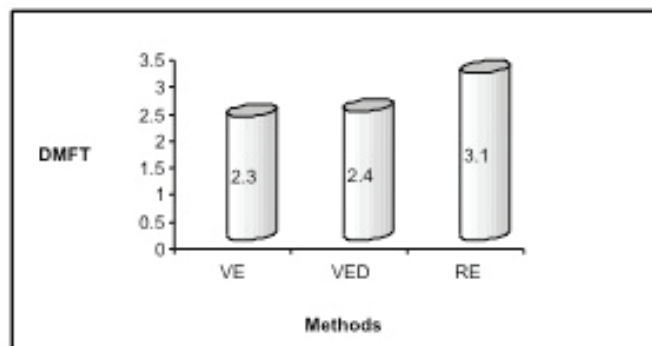


Figure 3: Caries experience (DMFT) by the methods used in the study. Visual Inspection (VI), Visual Inspection with drying (VID) and Bitewing Radiographic (BR).

DISCUSSION

The occlusal caries lesions represent the major part of the lesions found in permanent teeth^{2,3,14} and the use of fluoride in the prevention changed the pattern of the disease, making it difficult to diagnose it by traditional methods. The DMFT index, extensively used in the last 50 years in epidemiological surveys around the world, only registers lesions clinically cavitated. When the prevalence was higher, as in previous decades, the number of lesions was higher and the pattern was different from the current one, which influence in the performance of the method¹⁵. For the current reality, with low caries prevalence, the examinations are not done under ideal conditions, since diagnostic methods which could help in the visual examination are not used, underestimating a considerable amount of non-cavitated lesions¹⁶,

as shown in the results of this study. When the radiographic examination was used, the prevalence of noncavitated occlusal dentine caries was 56.4% in a city considered with a low caries prevalence.

In this present study the results of clinical and radiographic examination were compared and an assessment was made of how many and what types of caries lesion are detected.

Although the radiographic examination demonstrates low sensitivity in the detection of the early lesion caries, which are limited to the enamel, studies confirm this examination used with visual examination magnify significantly the accuracy of the diagnosis of the occlusal caries^{17,18}. However, Maschuilkiene *et al.*¹¹ (2004) do not recommend the regular use of bitewing examinations for caries diagnosis in clinical trial, because for these researchers, its contribution is small when compared to visual examination. However, the results of our study showed that, with the radiographic examination, 30.6% of these lesions would be underestimated. Also, when we analyzed the radiographic images of lesions with active white spots in enamel in surfaces without cavitation (non-presented data), 37.4% had already dentine lesions. Of the teeth which presented greyish discoloration under sound enamel (which could indicate a caries lesion), 32% did not present radiolucency in dentine, suggesting caries.

Opposing to Maschuilkiene *et al.*¹¹ (2004), Bloemendal *et al.*¹⁴ (2004) concluded the radiographic examination has no additional value for determining epidemiological trends in the prevalence of caries in a young populations in longitudinal study, for there is no indication that the trends and the prevalence of extra lesions of caries radiographically detected are different from the trends of the clinical prevalence. Even though, for the assessment of the prevalence of caries in a population at a certain point in time, radiographic examination does have additional value. In our study, the DMFT index was 2.3 (sd=2.5) in visual examination and increased to 3.1 (sd=2.3) when the result of the radiographic examination was added, and the percentage of adolescents free from caries reduced from 32.5 to 13.4, as shown in Figures 2 and 3. This increase in the number of lesions which would not be considered using traditional methods endangers the planning of oral health, for these lesions will be diagnosed when the enamel cavitation is evident or when the patient has a toothache, and, at this point, only the filling treatment cannot solve the problem, making it necessary other procedures which are more expensive, such as endodontic and prosthesis.

Of the 241 surfaces considered sound in the visual examination, but with radiolucency in the radiographic examination, 231 (95.8%) were in the outer third of the dentine, and 10 (4.2%) in the inner third. Even though, nowadays, there is evidence showing that caries lesions on the outer third of the dentine can be controlled through a diet control, use of fluoride and removal of the biofilm, without removing the decayed tissue and its consequent filling¹⁹.

According to the results of this study, the mean of noncavitated occlusal dentine caries in permanent molars was 1.68 and, 56.4% of the adolescents had at least one tooth affected by this type of lesion, and, of this percentage, 10% were in R3 (dentine caries in the deeper third). Considering that in 2004 the state schools in Piracicaba had approximately 19.700 students

enrolled, the underestimation reaches considerable values, that is, around 10.000 adolescents did not receive any treatment. So, despite the high percentage of noncavitated occlusal dentine caries, the focus in treatment could be a priority for those with deep caries, and preventative and health promotion for the others.

The use of radiography is rarely considered appropriate in epidemiological examinations, unless in those individuals who will receive dental treatment subsequent as part of the study¹⁹. It is important to point out that the dentist, in his office environment, when providing dental treatment and having access to information through radiographies, can have a great advantage in the detection of caries lesions, when compared to the epidemiologist. The new methods of diagnosis are rarely used in epidemiological studies either. Even though, in the future, the availability of the systems of reproductive quantitative detection can be an enormous advantage for research works. Methods using ionization can be limited for application; on the other hand, those using fluorescent laser can provide future tools for its use in epidemiology.

CONCLUSION

From the results of this research we can conclude that noncavitated occlusal dentine caries must be considered in epidemiological studies, and an auxiliary method to visual examination should be incorporated in further studies.

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RESUMO

Objetivo: O objetivo deste estudo foi determinar a prevalência de lesões de cárie não detectadas clinicamente em molares permanentes de estudantes em uma cidade com baixa prevalência de cárie. Foi utilizada combinação de exames radiográficos e visual. **Métodos:** A amostra compreendeu 1290 superfícies oclusais de molares permanentes, em 179 alunos com idades entre 12-15 anos. Os métodos utilizados foram: inspeção visual (VI), inspeção visual com secagem prévia (VID) e exame radiográfico (RE). Para a análise estatística, foram utilizados o CPOD e o CPOD modificado (incluindo exame radiográfico, lesões precoces e lesões microcavidades). **Resultados:** A média do CPOD foi de 2,3 (DP = 2,5), e 32,5% dos estudantes estavam livres de cárie segundo a VI. Das 918 superfícies diagnosticadas clinicamente

como híginas pela VI, 241 apresentaram radiolucidez em dentina na RE e a prevalência de cárie oclusal dentinária não-cavitada (por pessoa) foi de 56,4%. Das 404 superfícies diagnosticada como híginas na VID, 75 (18,6%) demonstraram radiolucência na dentina e a prevalência de cárie oclusal dentinária não-cavitada foi de 35,5%. Incluindo lesões dentinárias em RE, o CPOD foi de 3,1 (DP = 2,3), e 13,4% dos estudantes estavam livres de cárie. **Conclusões:** O exame radiográfico é eficaz em inquéritos epidemiológicos. No entanto, novos métodos para substituir este método devem ser avaliados, pois a dificuldade de transporte dificulta o seu uso frequente.

PALAVRAS-CHAVE: Epidemiologia, cárie dentária, radiografia dentária.

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