Prevalence of Noncavitated and Cavitated Carious Lesions in a Group of 5-year-old Turkish Children in Kadikoy, İstanbul

S.S. Kuvvetli, DDS, PhD *S.K. Cildir, DDS, MSc, PhD*
S. Ergeneli, DDS, PhD *N. Sandalli, DDS, PhD*

ABSTRACT

Purpose: The present study aimed to assess the prevalence of noncavitated and cavitated caries lesions in a group of five year old Turkish children.
Methods: A set of caries diagnostic criteria differentiating between active and inactive caries lesions at both noncavitated and cavitated levels was used to assess the caries status of the children. The examinations were performed on 300 children between 5 and 6 years of age.
Results: The mean number and prevalence of active shallow and deep cavitated caries lesions (2.43±0.22, 21.67% and 3.39±0.41, 16%) were found higher than active and inactive noncavitated caries lesions (1.70±0.16, 14.67% and 1.78±0.12, 15.67%). The mean dft and dfs score were determined as 1.93±0.17 and 2.47±0.29. The mostly affected surface by both noncavitated and cavitated lesions was occlusal of second molars in both arches, whereas the mean number of both type of lesions were much more higher in mandibular second molars. A significant association between the presence of noncavitated and cavitated lesions was found (χ_2=15.56, p<0.05).
Conclusions: Dental caries prevalence was relatively low in the primary dentition and the cavitated caries lesions were more common than the noncavitated lesions, however the prevalence of active and inactive noncavitated lesions were found considerably high in this group of Turkish children. **(J Dent Child 2008;75:158-63)**

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It is accepted that, in the prevention and management of dental caries, diagnosis of early carious lesions is essential[1,2] and mandatory for achieving the preservation of tooth structure and promotion of oral health.[3]

It has beeen emphasized that the inclusion of incipient caries lesions in the measurement of dental caries status is necessary for performing clinical and epidemiological studies.[3-8] Furthermore, it has been claimed that the conventional scoring systems—which had a very generalized approach for the diagnosis of dental caries—did not take into account the scientific information about the etiology, histopathology, risk factors, and dynamic nature of the disease.[1]

The diagnostic criteria known as the D1-D3 scale, originally developed by the World Health Organization[9,10] and then modified by Pitts[4,5] and Ismail,[1,3] reflect the different stages of the caries process. As described by Nyvad et al, a more detailed set of clinical caries diagnostic criteria differentiating between active and inactive caries lesions at both the noncavitated and cavitated levels.[7] The reliability and validity of these scoring systems has been well documented.[1,4,6,7]

Detection and monitoring of early noncavitated lesions is critical in determining efectiveness of preventive measures as a nonsurgical alternative for the treatment of decay in children. [2] In addition, statistics of noncavitated lesions,

Drs. Kuvvetli, Cildir, and Ergeneli are assistant professors, and Dr. Sandalli is professor and head, all in the Department of Pediatric Dentistry, Faculty of Dentistry, Yeditepe Universitv. İstanbul, Turkey.
Correspond with Dr. Kuvvetli at sskuvvetli@yahoo.com.tr

particularly on free and approximal smooth surfaces, are less likely to be distorted by restorative treatments. They also provide a basis for hypotheses about the potential of preventive, noninvasive treatment, the importance of which is certain to increase in the near future.[8]

Few studies have reported on the assessment of prevalence of noncavitated and cavitated carious lesions in the primary dentition.[1,2,7,11] The mean number of noncavitated carious lesions was found to be higher than cavitated lesions in those studies, and the significant prevalence of initial lesions was estimated as an indicator that the inclusion of these lesions into caries diagnostic criteria may be a tool for the risk group selection.[6]

The objectives of the present study are to:

1. assess the prevalence of noncavitated and cavitated caries lesions in the primary dentition; and
2. determine the distribution of caries frequency in a group of 5-year-old Turkish children.

METHODS

This study involved 300 children from 6 of 41 nursery schools in Kadıköy County in Istanbul, Turkey. Children were randomly selected from the records of the Kadıköy Institute of National Education, Istanbul, Turkey, using a stratified proportional random sampling strategy. A total of 162 boys and 138 girls between 5 and 6 years of age participated in the study. The schools provided a written consent from parents/guardians before the examinations.

Two calibrated pediatric dentists performed the examinations in the dental clinic of the Department of Pedodontics in the Faculty of Dentistry, Yeditepe University, Istanbul, Turkey. The caries diagnostic criteria presented by Nyvad et al[7] was used to assess the children's caries status.

According to these criteria the teeth with normal enamel translucency and texture were recorded as "sound—score 0."

The teeth showing whitish/yellowish, opaque enamel surfaces lacking luster, possessing a rough texture when the tip of the probe was moved gently across their surfaces, and with no clinically detectable loss of substance, were defined as having "active noncavitated caries–score 1."

The teeth with the same criteria as active noncavitated caries—and which had localized surface defects in enamel only and no undermined enamel or softened floor detectable with the explorer—were recorded as having "active shallow cavitated caries–score 2."

When an enamel/dentin cavity was easily visible with the naked eye and the cavity surface felt soft or leathery on gentle probing, the lesion with or without pulpal involvement was recorded as "active deep cavitated caries–score 3."

The teeth with shiny and white, brown, or black enamel surfaces which felt hard and smooth when the tip of the probe was moved gently across their surfaces and also had no clinically detectable loss of substance were recorded as "inactive noncavitated caries–score 4."

The teeth with the same criteria as inactive noncavitated caries—which had a localized surface defect (microcavity) in enamel only and no undermined enamel or softened floor detectable with the explorer—were defined as having "inactive shallow cavitated caries–score 5."

"Inactive deep cavitated caries—score 6" was given to those teeth with an enamel/dentin cavity easily visible with the naked eye; a shiny surface of cavity that felt hard on gentle probing, and no pulpal involvement.

Lastly, sound restorations were given a score of 7, restorations with active caries were scored an 8, and restorations with inactive caries were scored a 9.

The examiners had discussed the criteria and calibration before the actual examinations were performed. Interexaminer reliability of the caries diagnostic criteria was determined by re-examining 36 children (12% of the subjects) by the examiners. The percent agreement was 90% and the kappa value was 0.88, indicating a substantial level of agreement.

Caries was diagnosed by visual examinations using a dental mirror and dental operating light on a dental unit. The differentiation of the caries lesions were based on visual and tactile criteria. The teeth surfaces were dried with compressed air. An explorer was used only to clean the tooth surface from bacterial deposits and confirm the loss of surface smoothness or loss of tooth structure.

Table 1. Mean Number and Prevalence of Caries Lesions per Child

N=300	Mean±(SD)	Range	Prevalence (%)
Active noncavitated caries	1.70±1.11	1-6	15
Active shallow cavitated caries	2.43±1.79	1-8	22
Active deep cavitated caries	3.39±2.89	1-18	16
Inactive noncavitated caries	1.78±0.88	1-4	16
Inactive shallow cavitated caries	2.00±1.63	1-6	3
Inactive deep cavitated caries	2.00.00±0.00.81	1-3	1
Filling (sound)	2.63±1.49	1-5	6
Filling+active caries	1.77±0.97	1-3	3
Filling+inactive caries	1.14±0.37	1-2	2
Decayed or filled primary teeth	1.93±2.94	0-18	52
Decayed or filled primary tooth surface	2.47±5.17	0-62	52

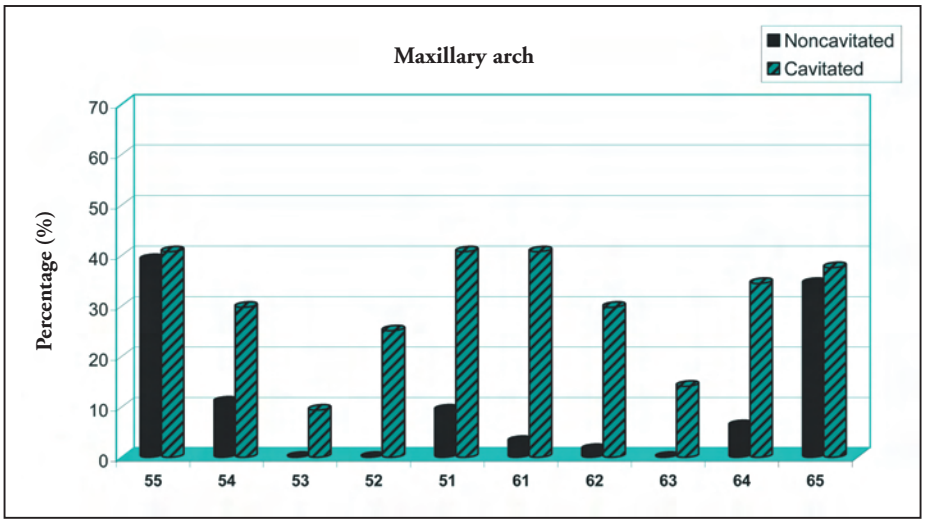

Figure 1. Prevalence of noncavitated and cavitated lesions in maxillary arch, by tooth type (%).

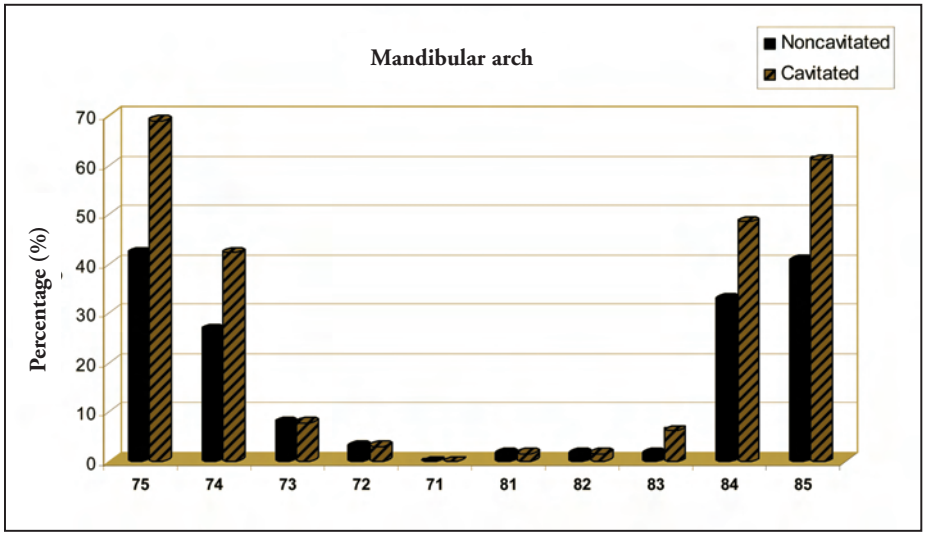

Figure 2. Prevalence of noncavitated and cavitated lesions in mandibular arch, by tooth type (%).

STATISTICAL ANALYSIS

Statistical analysis was performed with the GraphPad Prisma program v.3 for Windows (GraphPad Software, Calif, USA) Besides standard descriptive statistical calculations of mean, median, standard deviation, and 95% confidence interval, chi-square test was performed during the evaluation qualitative data.

RESULTS

Three hundred children (138 females, 162 males) between 5 and 6 years of age were examined. The mean age of the children was 5.27 years. The total number of examined primary teeth was 5,835. Of these, 2,400 were primary molars and the remaining teeth were primary incisors and canines. Also, the erupted permanent teeth were recorded as 167 first molars (36 maxillary right, 44 maxillary left, 44 mandibular left and 43 mandibular right molars), 6 maxillary incisors (3 right and 3 left central incisors) and 117 mandibular incisors (54 right central, 5 right lateral, 52 left central and 6 left lateral incisors). One hundred thirty-seven (46%) of the children experienced caries in the primary dentition.

The mean number and prevalence of cavitated and noncavitated (active or inactive) caries lesions, sound restorations, and restorations with active and inactive caries lesions are shown in Table 1. The mean number of active shallow and deep cavitated caries lesions (2.43±0.22 and 3.39±0.41) was found to be higher than active and inactive noncavitated caries lesions (1.70.00±0.16 and 1.78±0.12). The prevalence of active shallow cavitated caries lesions was found to be the highest (22%) and the prevalence of inactive deep cavitated caries was found the lowest for the entire group of children (1%). The mean dft and dfs scores were determined as 1.93±0.17 and 2.47±0.29.

In the prevalence of noncavitated and cavitated lesions by tooth type, cavitated lesions were more prevalent than the noncavitated lesions in all maxillary teeth. The prevalence of noncavitated and cavitated lesions was close in primary maxillary second molars (Figure 1). Cavitated lesions were more prevalent than noncavitated lesions in mandibular molars in both quadrants. The mandibular incisors were less affected by both types of lesions (Figure 2). Noncavitated lesions were more common on the primary mandibular first molars (33% right and 27% left) than on the primary maxillary first molars (11% right and 6% left) and noncavitated lesions were more common on the primary mandibular second molars (41% right and 42% left) than on the pirmary maxillary second molars (39% right and 34% left).

Table 2 shows the mean number of noncavitated and cavitated lesions by tooth type and surface. The surface most affected by both noncavitated and cavitated lesions was the occlusal surface of primary second molars in both arches, whereas the mean number of both types of lesions was much higher in primary mandibular second molars. While both types of lesions were common on the mesial and distal surfaces of pirmary maxillary central and lateral incisors, the mean number of cavitated lesions on the buccal

Table 2. The Mean Number of Primary Tooth Surfaces by Caries Status and Tooth Type

	MAXILLA				MANDIBLE				
Non-cavitated	Incisors	Canines	First molars	Second molars	Non-cavitated	Incisors	Canines	First molars	Second molars
Occlusal	0.00±0.00	0.00±0.00	0.02±0.01	0.06±0.03	Occlusal	0.00±0.00	0.00±0.00	0.06±0.03	0.12±0.04
Mesial	0.02±0.02	0.00±0.00	0.00±0.00	0.03±0.02	Mesial	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Distal	0.01±0.01	0.00±0.00	0.02±0.02	0.00±0.00	Distal	0.00±0.00	0.00±0.00	0.03±0.02	0.00±0.00
Buccal	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	Buccal	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Lingual	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	Lingual	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
	MAXILLA				MANDIBLE				
Cavitated	Incisors	Canines	First molars	Second molars	Cavitated	Incisors	Canines	First molars	Second molars
Occlusal	0.00±0.00	0.00±0.00	0.00±0.00	0.06±0.03	Occlusal	0.00±0.00	0.00±0.00	0.04±0.03	0.11±0.04
Mesial	0.04±0.03	0.00±0.00	0.01±0.01	0.02±0.02	Mesial	0.00±0.00	0.00±0.00	0.00±0.00	0.03±0.02
Distal	0.01±0.01	0.00±0.00	0.04±0.03	0.00±0.00	Distal	0.00±0.00	0.02±0.02	0.11±0.042	0.00±0.00
Buccal	0.05±0.04	0.02±0.02	0.02±0.02	0.02±0.02	Buccal	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Lingual	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	Lingual	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

Table 3. The Association Between the Presence of Noncavitated Lesions and Cavitated Lesions*

	Cavitated lesions		
Noncavitated lesions	No	Yes	**Total**
No	163	40	**203**
Yes	57	40	**97**
Total	**220**	**80**	**300**

** Chi-square=15.56; P<.05.*

surfaces was the highest. The primary canines presented only cavitated lesions on their buccal and distal surfaces.

A significant association between the presence of noncavitated and cavitated lesions, was found (chi-square= 15.56, *P*<.05). Both noncavitated and cavitated lesions were observed simultaneously in 40 children (Table 3).

Figure 3 shows the distribution of caries frequency among the children according to the dft scores. One hundred sixty-three (54%) children were caries free. Of the remaining children, 67 had dft scores between 1 and 3 (24%), 47 had scores between 4 and 6, (16%), 12 had scores between 7 and 9 (4%), and 11 scored 10 and over (4%).

DISCUSSION

A detailed caries diagnostic criteria described by Nyvad et al that differentiated between active and inactive caries lesions at both cavitated and noncavitated levels in the permanent dentition was used in the study.[7] Nyvad et al's study suggested that caries diagnosis based on activity assessment can be performed with a high reliability, even when noncavitated caries diagnoses are included in the scoring system. Although this scoring system was applied in the permanent dentition, Autio-Gold and Tomar[2] reported a similar study using the same criteria, carried out on a group of 5-year-old children living in Alachua County, Florida. The present study's results were similar to that of Autio-Gold and Tomar, which showed a good interexaminer reliability for these caries diagnostic criteria. Their study claimed that differentiation between noncavitated and cavitated lesions is useful in assessing the primary dentition. Among the few studies in the English dental literature reporting on the assessment of the prevalence of noncavitated and cavitated caries lesions using different scoring systems in the primary dentition, Nyvad's scoring system was encountered in only 1 study.[2]

In the clinical diagnosis of dental caries, various methods are available besides visual and tactile examination, such as bitewing radiographies,[12] fiber optic transillumination (**FOTI**),[13] and laser-induced fluorescence.[14] It has been suggested that there is no one diagnostic method that can be relied upon to detect noncavitated carious lesions in all tooth surfaces. Also, while clinical examination must remain the basic detection system of dental caries, is by itself not very

accurate. Therefore, a need exists to augment clinical examination with additional data from FOTI, radiographs, or both.[3] In this study, the examinations were visual and the methods agreed with similar studies.[2,11,15] Future research may be focused on the evaluation of the combination of detailed caries diagnostic criteria with different diagnostic tools.

It was reported that noncavitated caries lesions were more prevalent than the cavitated ones in the previous studies.[1,2,11] This study found that the prevalence of active noncavitated caries lesions was less than active shallow cavitated lesions, but the prevalence of inactive noncavitated caries lesions were close to the prevalence of active deep cavitated lesions. Overall findings showed that cavitated lesions were more common than noncavitated lesions in this population. The reason for this contradiction may be the misdiagnosing of noncavitated lesions as sound surfaces in the present study. It can be speculated that the addition of diagnostic tools like FOTI or laser-induced fluorescence to visual examination may result in an increase in the number of incipient lesions.

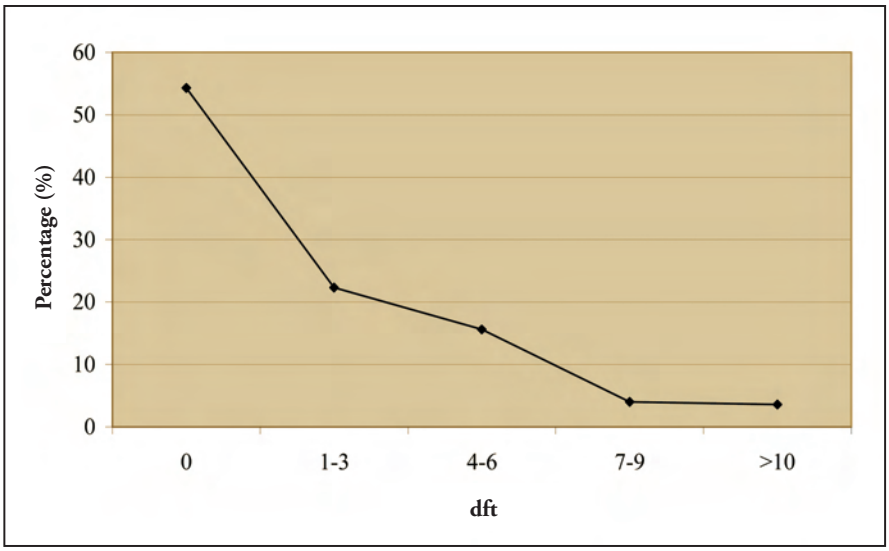

Figure 3. The distribution of caries frequency among five year olds.

When the results are compared to similar studies, the prevalence of active noncavitated caries lesions (15%) and the prevalence of shallow (22%) and deep (16%) cavitated lesions determined in the present study were close to the findings reported by Warren et al,[11] which showed 24% for noncavitated and 17% for cavitated caries lesions. Autio-Gold and Tomar[2] reported much higher prevalence values for active noncavitated lesions (71%) and cavitated dentinal lesions (48%), but the prevalence of enamel lesions (17%) were similar to the present study's findings.

Autio-Gold and Tomar[2] reported that active noncavitated lesions were common in the primary molars in both arches and the most commonly affected surfaces were the occlusal surfaces of the primary first and second molars in both arches. Also, in a recent study Elfrink et al evaluated the caries prevalence of primary molars in a group of Dutch 5-year-old children and concluded that primary second molars were more affected by caries than primary first molars in both arches and the differences in caries prevalence were the largest on the occlusal surface.[16] This is a similar finding observed in the present study, which showed that the surface most affected by both noncavitated and cavitated lesions was the occlusal surface of primary second molars in both arches and that the mean number of both types of lesions was much higher in pirmary mandibular second molars.

The presence of early enamel lesions is accepted as an indicator for the child having a significantly higher probability of possessing more than 1 dentinal lesion.[1,2,11] Furthermore, it has been reported that the factors causing maxillary anterior caries may markedly contribute to the high prevalence of dental caries in posterior primary teeth.[17] In the present study, a significant association was found between the presence of noncavitated lesions and cavitated lesions. This study also showed that 13% of the children with caries experience had 1 or more early enamel lesions and at least 1 dentinal lesion at the same time and those with any noncavitated lesions were more likely to also have a cavitated lesion. These findings agreed with the other studies.[1,2,11]

Amarante et al[6] reported dmfs values for 5-year-olds as 2.69 when dentinal caries was considered. With the inclusion of enamel caries, the total score was reported as 5.38. Autio-Gold et al[2] reported the dfs values for cavitated lesions in 5-year-olds as 4.29. A smaller dfs value was determined (2.47) for noncavitated and cavitated lesions in the present study. The results of 4 cross-sectional studies carried out in Jönköping, Sweden—which was reported by Hugoson et al[18] showed a decrease in the dfs scores of the individuals at different ages. For the 5-year-old group, the dfs score was reported as 11.2 and 3.7 in 1973 and 1993, respectively[18]–a value similar to that found in the present study.

The distribution of caries frequency among this group of 5-year-old children showed that only 4% of the children had dft scores of 10 and more and the number of children who were caries free were fairly high (54%). This finding is understandable, considering the age and the socioeconomic conditions of this study's population. Kadıköy is one of the largest and most well-developed counties in Istanbul. Among the selected schools that responded positively in this study, 5 were private schools. Only 1 public school had the opportunity to bring the children to the faculty. In addition, the parents of the children from both types of schools were well educated and from a middle and high socioeconomic status. In a previous study, Ismail et al[19] reported that high school students from private schools had a significantly

lower caries prevalence than students from public shools. A study performed on a larger sample, however—one that includes a higher number of private and public schools—is necessary to support those findings.

CONCLUSIONS

Based on this study's results, the following conclusions can be made:

1. Dental caries prevalence was relatively low in the primary dentition and the cavitated caries lesions were more common than the noncavitated lesions. The prevalence of active and inactive noncavitated lesions, however, was considerably high in this group of Turkish children.
2. This study's findings support the significance of the inclusion of noncavitated caries lesions in the assessment of primary dentition
3. Determining moderate and high-risk individuals among 5-year-olds appears to be of clinical importance in the effective application of caries preventive measures before the begining of mixed dentition.

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