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# Caries pattern in primary molars in 5-year-old Dutch children



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**Based on:**

**Caries pattern in primary molars in Dutch 5-year-old children**

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## ABSTRACT

*Aim:* The aim of this study was to investigate the difference in caries prevalence based on quadrant decayed missing filled surfaces (dmfs) data between first and second primary molars in 5-year-old Dutch children.

*Materials and methods:* For this cross-sectional observational study 692 children, all insured by a Health Insurance Fund, living in one of four selected cities in the Netherlands were asked to participate in the study. From the original cohort 435 children (49% girls) participated. Clinical examinations were performed and only carious lesions with involvement of the dentine were reported. Lesions on the occlusal, buccal, palatal/lingual, mesial and distal surfaces as well as lesions in buccal and palatal pits and fissures were reported separately. No radiographs were taken. Systematic differences in dmfs between first and second molars in the same quadrant of each primary dentition were tested with the Wilcoxon signed rank test.

*Results:* Second primary molars, even after correction for caries in pits and buccal/palatal fissures, had a statistically significant higher total dmfs than the first primary molars. The differences were mainly found on the occlusal surfaces. On proximal surfaces, the first primary molars had significant more caries than the second primary molars. The d-component constituted the major part of the caries index.

*Conclusions:* Second primary molars, corrected for decay in the pits and buccal/palatal fissures of this molar, are more affected by caries than first primary molars and the differences in caries prevalence are the largest on the occlusal surface. The specific site of the caries found suggests that developmental disturbances in second primary molars may attribute to their prevalence.

## INTRODUCTION

The caries prevalence in 5-year-old children in the Netherlands, as in other developed countries, has declined since 1975 (1). Caries can affect each tooth and surface, with a predilection for pits, fissures and proximal surfaces (2, 3). Caries at other, less vulnerable, sites could be a sign of severe caries (3). However, caries patterns can also be associated with aetiology (4). Many investigators have tried to find a pattern for predicting caries (3, 5) as this becomes more important when caries prevalence in the population is declining (3). In the primary dentition, molars are the teeth most often affected (3, 6-9). The occlusal surface seems to be most vulnerable (3, 6, 8, 10). The second primary molars are more often affected by caries than the first primary molars (3, 6, 8, 10, 11). In European countries investigations have described the caries pattern. In the United Kingdom, Holt found that at the age of 5 caries mainly affects the primary molars, especially the second primary molar (3). In 4-year-olds in Ireland it was also noted by Holland and Crowley (6) that the second primary molars are most commonly affected by caries. Not only in Europe has this been seen but also in the USA 5-year-olds show more caries lesions on the second molars, especially in the mandible (12). Elsewhere in the world, for example in 4-year-olds in Beijing (China), occurrence of caries is also higher in the second primary molar than the first primary molar. The most striking differences were seen on the occlusal surfaces (11). This is also not a new phenomenon: Watt et al. (13) investigated the caries prevalence in the primary dentition of a mediaeval population in Scotland. They noticed that first primary molars generally showed a lower caries prevalence than second primary molars, significantly lower for the older age band (6-12.9 years). Up to now however all the studies mentioned above were based on dmft data and the dmfs has rarely been studied. Accordingly, the aim of this study is to look for a comparable difference in caries prevalence between the surfaces of first and second primary molars in 5-year-old Dutch children.

### Materials and methods

*Participants.* In 1999 an epidemiological study was performed to evaluate the oral health in young people insured by Health Insurance Funds. In the Netherlands, insurance by such funds was compulsory for individuals earning less than some income criterion and their family members, covering altogether approximately 60% of the Dutch population. Professional oral care for children is included in this insurance (1).

The study was located in four Dutch cities; Gouda, Alphen aan de Rijn, 's Hertogenbosch and Breda. In each city, three districts were chosen. The trends seen in these cities are accepted to be representative for the trends in the Netherlands (14). The parents of 692 5-year-old children received a letter about the investigation and were asked to give permission for participation of their child in the investigation. In the clinical part of the study 435 children (63%) participated.



*Measures.* A non-response investigation was completed in 164 5-year-olds to look for differences between participants and non-participants. The parents of non-participating children completed a questionnaire about feeding, fluoride, oral hygiene, dental visits and dental treatments. Also parents of participating children filled out such a questionnaire.

The dental examination was performed in a dental van equipped with dental chair, lamp etc. Dental examinations were performed by seven previously calibrated dentists. Tooth surfaces were evaluated by visual examination. If in doubt, a dental probe was used for plaque removal, detection of fissure sealants and careful examination of surfaces. Only carious lesions with involvement of the dentine were reported. Lesions on the occlusal, buccal, palatal/lingual, mesial and distal surfaces as well as lesions in buccal and palatal pits and fissures were reported separately. Due to medical ethical reasons, no radiographs were taken. The inter-examiner agreement was tested by a duplo-investigation in fifty children. The test-retest-correlation was calculated and was very high for dmfs ( $r=0.99$ ).

*Statistics.* The data were entered in a computer file, decayed missing filled teeth/surfaces (dmft/dmfs) indices were computed, using SPSS 11.0. To test the statistical differences between first and second primary molars, the Wilcoxon's signed rank test was used. For the test to compare dmfs of both primary molars, a p-value  $<0.05$  was used as an indication of significance, for different surfaces we use a p-value  $<0.01$  as a correction for multiple testing.

## RESULTS

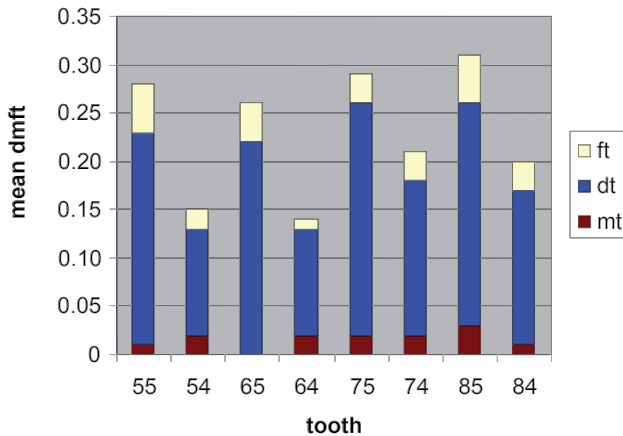
In this study 435 (49% girls) of the 692 selected children participated. Causes for non-participation were: not at home when visited (9%), no consent (22%), not at school at time of examination (4%), fearful child (1%), failing appointment (1%). The non-response study for variables with respect to gender, social economic status and oral health, resulted in comparable outcomes in both studied groups. The mean dmft was 2.5 for all primary teeth, 51% of the children had no carious lesions in their primary dentition. The distribution of the children according to the number of dmft is shown in Table 4.1.

**Table 4.1:** Distribution of 5-year-old children according to the total number of decayed, missing and filled teeth (dmft) based on oral examinations without the support of radiographs.

	dmft				
	0	1-5	6-10	11-15	16-20
Percentage of children	51	32	11	5	1

The d-component constituted the major part of the dmft-index, see Figure 4.1. In the 55, for example, the mean dmft was 0.28 and the mean decayed teeth (dt) 0.22. Therefore, almost 80% of the dmft number was due to untreated decay. Furthermore, the dmft number of second primary

molars was higher than that of first primary molars in the same quadrant. The mean dmft in second primary molars varied between 0.26 and 0.31, the mean dmft in first primary molars varied between 0.14 and 0.21 (Figure 4.1). There were no fissure sealants found in primary molars in this investigation. After this, the second primary molars had still significantly more dmfs (Figure 4.2). Because first primary molars have no buccal pit or palatal fissure, we excluded these sites in the comparison between first and second primary molars with respect to dmfs.



**Figure 4.1:** Mean caries as dmft per tooth in a Dutch population of 5-year-old children.

ft = filled teeth

dt = decayed teeth

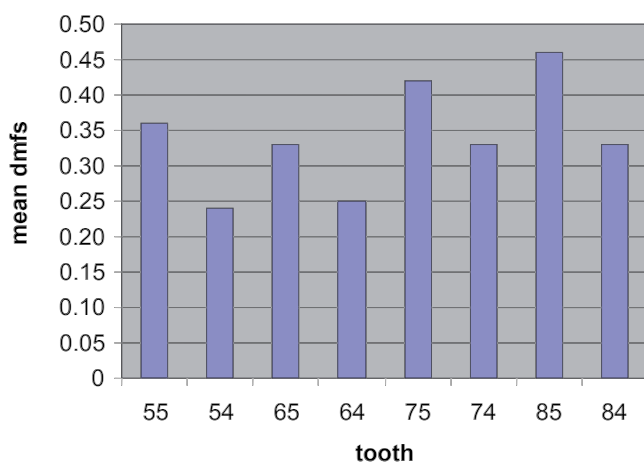
mt = missing teeth

In Table 4.2 and Figure 4.2, the mean dmfs per surface is given for each primary molar separately. There were not only significant differences in total dmfs between first and second primary molars, but also at the surface level where significant differences were seen (Table 4.2 and Figure 4.2). The differences on the occlusal surface were most prominent; in each quadrant the second primary molar had significantly more caries than the first primary molar in the same quadrant ( $p < 0.001$ ). The second primary molars had a mean dmfs score on the occlusal surface between 0.23 and 0.28. The first primary molars had a mean dmfs score between 0.07 and 0.15. The differences between first and second primary molars on the smooth surfaces (pits and fissures excluded) were only significant for the mandible. The mean dmfs of the 75 and 85 was 0.05 and 0.06, for teeth 74 and 84 the mean dmfs was 0.01 ( $p < 0.001$ ). On the proximal surface it was the other way around: in all quadrants the first primary molars had more caries (mean dmfs of 0.16-0.19) than the second primary molars (mean dmfs of 0.08-0.12) ( $p < 0.05$  and  $p < 0.001$ ).

**Table 4.2:** Average dmfs score in 5-year-old children based on oral examinations (without x-rays) of individual primary teeth.

Tooth	Dmfs occlusal surface	dmfs approximal surface	dmfs smooth surface	dmfs excl pit and fissure
55	0.23***	0.10**	0.03	0.36***
54	0.07	0.16	0.02	0.24
65	0.23***	0.08***	0.03	0.33*
64	0.09	0.16	0.01	0.25
75	0.26***	0.11***	0.05***	0.42**
74	0.14	0.19	0.01	0.25
85	0.28***	0.12*	0.06***	0.46***
84	0.15	0.17	0.01	0.33

\* significant difference with the same surface of the adjacent first primary molar (\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ )

**Figure 4.2:** Mean caries as dmfs per tooth in a Dutch population of 5-year-old children.

## DISCUSSION

The study population consisted of children insured by the Heath Insurance Funds, so in this sample, the lower social classes were over-represented. Children from higher social classes are reported to have on average lower dmfs scores than those from lower classes (1). Also the dmfs score in this report may be higher than the dmfs of Dutch children in general. However as the participation rate in this investigation was 63%, the opposite may also be true. Moreover, as no radiographs were taken, caries lesions are under recorded, which can result in a difference in caries estimation up to a level of 60% (5).

As can be seen, the d-component constituted the major part of the caries index. This finding has been confirmed by earlier studies (8, 11, 12). This is seen as an important finding and there is still a need for further investigations on this subject (5). Our study confirms that second primary molars have more caries than first primary molars (3, 6, 8, 10, 11).

Furthermore we also looked at the different surfaces to see if second primary molars have more caries on all these surfaces. On the proximal surface the opposite was noted: first primary molars had significantly more caries lesions than second primary molars. This can be explained by the fact that at the age of 5 the first permanent molars are not erupted yet, so the second primary molar has only one proximal surface (mesial) which is in contact with another tooth. On the contrary, the first primary molar has contact points with both the canine and the second primary molar, creating an additional predilection site to develop proximal caries. If radiographs had been used, the difference between the number of proximal dmfs of both molars might even have been larger. The total difference in dmfs between first and second primary molars was mainly found to be related to the caries incidence on the occlusal and buccal surfaces.

Possible causes for the difference in caries prevalence are:

- plaque retention: brushing the second primary molar is more difficult than brushing the first primary molar and natural cleaning is probably better on the first primary molar;
- eruption-time: the first primary molars erupt earlier than the second primary molars;
- anatomy of the tooth;
- prevalence of developmental disturbances in the primary dentition.

Plaque retention could be an explanation, but plaque is not the only cause of caries. Feeding pattern, tooth brushing and fluoride intake are also very important and most likely comparable for first and second primary molars in the same oral cavity (4).

The second primary molars erupt 10-12 months later than the first primary molars, at an age of 24-30 months (15). One could assume that the first primary molar has more caries due to a longer presence in the oral cavity. But this is not supported by the literature. Only in special cases (e.g., early childhood caries) are the teeth attacked by caries in sequence of eruption (16, 17).

The anatomy of the tooth could also be an explanation. In 1981, Bimstein et al. investigated which tooth surface is most likely to develop caries. They found that the difference in caries prevalence between the first and second primary molar could be explained by the buccal pit in the second molar in the mandible and the palatal fissure in the second molar in the maxilla (2). Since we excluded these surfaces, the tooth-anatomy was not a major explanation for the differences seen. This is supported by other authors (17). Fissure sealants in the primary molars also influence the anatomy of the fissures. But in this investigation, the children did not have sealants in their primary molars. So that was also not an explanation for the differences found.

Developmental defects can also be an explanation. In the permanent dentition Molar Incisor Hypomineralisation (MIH), hypomineralisation of systemic origin of 1-4 permanent first molars, frequently associated with affected incisors, occurs. Clinically, MIH molars have an abnormality in





the translucency of the enamel due to hypomineralisation (18). Although it does not always occur, the hypomineralised enamel can chip off easily leading to unprotected dentine and unexpected rapid caries development (18). Due to a higher sensitivity to caries, these molars are sometimes restored extensively (19). The unusual form of the restoration often indicates, however, that a caries lesion may not have been the only reason for restoration (19). Fissure sealants in MIH molars seem to protect against breakdown and encourage further post-eruptive maturation (20). In addition, teeth with hypoplasia in the primary dentition are more vulnerable for caries (21, 22). Sometimes in second primary molars MIH-like opacities are seen (Figure 4.3). This is completely different from a caries lesion, as seen in Figure 4.4. In this investigation we can only hypothesize on the size and form of the restorations, so more investigations are needed. Further studies, looking at the amount of dental decay and possible developmental disturbances, are needed, such as investigations done in the permanent dentition for MIH molars. Furthermore, other possible causes have to be taken into account. Discussion of the possible causes suggests that developmental disturbances are among the best explanation for the differences in caries prevalence found. If developmental disturbances in the second primary molars are an important cause for this difference, their prevalence has to be rather high, which needs confirmation.



**Figure 4.3:** Intra-oral photograph of tooth 65 (upper left second primary molar) showing a compomer restoration and developmental disturbances of the enamel.



**Figure 4.4:** Intra-oral photograph of tooth 85 (lower right second primary molar) shows a caries lesion on occlusal surface, reaching into the dentine.

## CONCLUSION

Second primary molars have more caries than first primary molars and the differences in caries prevalence are the largest on the occlusal surface. The causes are yet unknown, but developmental disturbances may be amongst them.



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