Deciduous molar hypomineralisation, its nature and nurture

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Factors increasing the caries risk of second primary molars in 5-year-old Dutch children

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Based on:

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ABSTRACT

Aim: Caries is still a prevalent condition in 5-year-old children. At present, knowledge regarding some aetiological factors, like Deciduous Molar Hypomineralisation (DMH), is limited. The aim was to investigate aetiological factors both directly and indirectly associated with caries in second primary molars.

Materials and methods: Of 974 children invited to participate in the study, 386 children were examined clinically with visual detection of caries. Only carious lesions determined to have reached the dentine were recorded. Information about tooth brushing frequency, education level of the mother, and country of birth of mother and child, was collected by means of a multiple-choice questionnaire. Parents of 452 children filled in the questionnaire. Complete clinical and questionnaire data were available for 242 children. Statistical analysis of the effect of the independent variables was undertaken using the Pearson's chi-square test.

Results: Deciduous Molar Hypomineralisation ($p=0.02$) and the country of birth of the mother ($p<0.001$) were positively associated with caries prevalence.

Conclusions: Deciduous Molar Hypomineralisation and the country of birth of the mother play a role in the prevalence of dental caries in the second primary molar. These aetiological factors associated with childhood dental caries need to be investigated further in longitudinal clinical trials.

INTRODUCTION

Caries prevalence of 5-year-old children in the Netherlands, as in other developed countries, has declined since 1975 (1). Since 1993, the decayed missing filled surfaces (dmfs) score of 5-year-olds has slightly increased again, however, the differences between the data of 1999 and 2005 are not statistically significant (2). To improve the efficacy of preventive measures it has become more important to identify increased caries risk as caries prevalence in the population is declining (3). Many investigators have tried to develop a method for predicting caries (3, 4) or tried to identify aetiological factors (5). In the primary dentition, molar teeth were most often reported to be affected by dental caries (3, 6-8) and of these, the occlusal surface seemed to be most susceptible (3, 7, 9). The second primary molars were reported to be more often affected by caries than the first primary molars (3, 7, 9-11). The second primary molars erupt 10-12 months after the first primary molars at the age of 24-30 months (12), leading to the assumption that the first primary molars have a greater prevalence of caries due to a longer presence in the oral cavity. Hypomineralisation of the second molars could be an explanation for the differences in caries prevalence between first and second primary molars (11, 13, 14). Hypomineralisation in the second primary molars has not been investigated as a putative caries-influencing factor previously. Most of the putative aetiological factors for dental caries have been studied extensively. Feeding pattern, tooth brushing, and fluoride intake influence the prevalence of caries in general and are most likely comparable for first and second primary molars in the same oral cavity (5). Other factors, such as the education level of the mother, country of birth, and gender of the child are also seen as influencing factors for caries in general (15), but not influencing the caries in second primary molars alone.

The aim of this study was to investigate aetiological factors both directly and indirectly associated with caries in second primary molars.

MATERIALS AND METHODS

Participants. As part of a Dutch standardized epidemiological survey in 2005, the parents of 974 5-year old children received a letter describing the study and were asked to provide consent for the participation of their child. The parents of 495 children (51%) gave permission. The dentitions of 386 children were examined for caries and Deciduous Molar Hypomineralisation (DMH). DMH is defined as idiopathic hypomineralisation of 1-4 second primary molars (16).

The parents of these children were insured by Health Insurance Funds, under which approximately 60% of the Dutch population was insured. Professional oral care for children was 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 considered representative for the trends in the Netherlands (17).

Ethical approval was given for this study by the Medical Ethics committee from Amsterdam Medical Centre.

Measures. To obtain information regarding toothbrushing frequency, education level of the mother, and country of birth of mother and child, a multiple-choice questionnaire was used. The parents of 452 5-year-old children completed the questionnaire. Toothbrushing frequency was scored as either less than one time a day, one time a day, and two or more times a day. The other factors were scored dichotomously: the education level of the mother scored 'high' if highschool was completed and/or a bachelors or masters degree obtained and 'low' for all other educational standards. The country of birth was divided in 'the Netherlands' and 'other countries'.

Parents who did not return the consent form for the clinical component were contacted personally. Of these parents, 146 were willing to fill out a short questionnaire (the non-response questionnaire) to complete investigating differences between participants and non-participants. The parents of non-participating children completed the same questionnaire about tooth brushing frequency, education level of the mother, and country of birth of mother and child.

In the clinical component of the study, 386 of 974 children (39.6%) participated. The dental examination was performed by five calibrated dentists in a dental van, equipped with dental chair, lamp, syringe, etc. 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 the surfaces. Due to medical ethical reasons, no radiographs were taken. A dmfs score was recorded in all teeth. Only carious lesions determined to have reached into the dentine were scored. The second primary molars of 5-year-olds were evaluated by visual examination for DMH characteristic hypomineralisation, such as demarcated opacities, posteruptive enamel loss and atypical restorations, using the criteria shown in Table 4.3. Teeth with fluorosis were excluded from the DMH scorings. During calibration sessions the examiners were trained in detecting the dentinal caries and hypomineralised molars. Twelve per cent of the children were re-examined. The inter-examiner agreement was high (r=0.96).

Statistics. The data were entered in a computer spreadsheet; dmft and dmfs indices were calculated using SPSS version 15.0 (SPSS Inc, Chicago, IL, USA). To determine the influence of the independent variables DMH, education level of the mother, gender of the child, brushing frequency, and country of birth of mother and child separately on the prevalence of caries in the second primary molars, the Pearson's chi-square test was used. The critical level for alpha was set at 0.05. Subsequently, the statistically significantly related factors with caries as a dependent variable were also examined using binary logistic regression analysis.

Table 4.3: Scoring criteria for DMH (Deciduous Molar Hypomineralisation).
Adapted from the EAPD criteria for scoring MIH (Molar Incisor Hypomineralisation) in the permanent dentition (31).

Atypical restoration	The size and form of the restoration do not fit in the present caries distribution.
Opacity	There is a defect involving an alteration in the translucency of the enamel, variable in degree. The defective enamel is of normal thickness with a smooth surface and may be white, yellow or brown in colour. The demarcated opacity is not caused by caries, fluorosis or amelogenesis imperfecta etc.
Posteruptive enamel loss	A defect indicating a deficiency of the surface after eruption of the tooth, possibly caused by factors such as trauma and attrition. Enamel loss due to erosion is excluded.

RESULTS

In this study, 386 (45% of whom were female) of the 974 selected children participated in the clinical part of the investigation (39.6%). Causes for non-participation were: not interested (n = 106), lack of time (n = 13), fearful child (n = 39), language problems (n = 15), no show (n = 40), other reasons (n = 46).

The questionnaire was completed by 452 parents of the 5-year-olds (response rate 46%). There were no statistically significant differences between participating and non-participating children for tooth brushing frequency, education level of the mother, and country of birth of mother and child. In 242 children, both the results of the clinical examination and the questionnaire were available. The majority of participants (85%) brushed with fluoridated toothpaste. The parents of 5% of the participants did not know if the toothpaste contained fluoride or not.

Of the 386 children examined, 171 (44%) were caries-free. The mean dmft score in the primary dentition was 2.9 (Fig. 4.5). The d-component constituted the major part of the dmft index. Sealants were also scored, but only present in a few cases. From these 386 children, the mean dmft per tooth of second primary molars varied between 0.26 and 0.35; the mean dmft per tooth of first primary molars was (significantly) lower than in second primary molars; 0.19 and 0.27 (Fig. 4.5). There were statistically significant differences between dmfs scores in first and second primary molars on the occlusal surface (paired t-test, $p<0.001$) (Fig. 4.6). Of the children with dmft≥1, 80% had caries on one or more occlusal surfaces of the second primary molars. For the occlusal surface of the first primary molars it was 53.5%. Gender, tooth brushing frequency, education level of the mother, and country of birth of the child were not related to the presence of caries in the second primary molar with any statistical significance. The data analysis indicated that DMH and the country of birth of the mother had statistically significant influence on caries prevalence ($\chi^2 = 5.31$, d.f. = 1, $p = 0.02$) ($\chi^2 = 19.42$, d.f. = 1, $p<0.001$) respectively (Table 4.4). The binary logistic regression indicated that children with DMH have 3.2 times (95% CI: 1.13-9.09) the risk of having caries in the second primary molars than children without DMH and that children

with a mother not born in the Netherlands have 3.5 times (95% CI: 1.98-6.07) the risk of caries in the second primary molars than children with a mother born in the Netherlands.

Table 4.4: Factors associated with caries prevalence in second primary molars.

Factor		Children with caries (%)	Children without caries (%)	p-value
DMH (Deciduous Molar Hypomineralisation)	Yes	14 (7.6 %)	5 (2.5%)	0.02*
	No	171 (92.4%)	196 (97.5%)	
Education level mother	High	16 (17.0%)	34 (25.4%)	0.13
	Low	78 (83.0%)	100 (74.6%)	
Brushing frequency	2≤ times	55 (56.1%)	79 (55.6%)	0.99
	0 or 1 times	43 (43.9%)	63 (44.4%)	
Country of birth mother	The Netherlands	48 (48.5%)	108 (76.1%)	<0.001*
	Other country	51 (51.5%)	34 (23.9%)	
Country of birth child	The Netherlands	96 (97.0%)	138 (97.9%)	0.66
	Other country	3 (3.0%)	3 (2.1%)	
Gender	Girl	65 (42.8%)	72 (47.4%)	0.42
	Boy	87 (57.2%)	80 (52.6%)	

* statistically significant difference

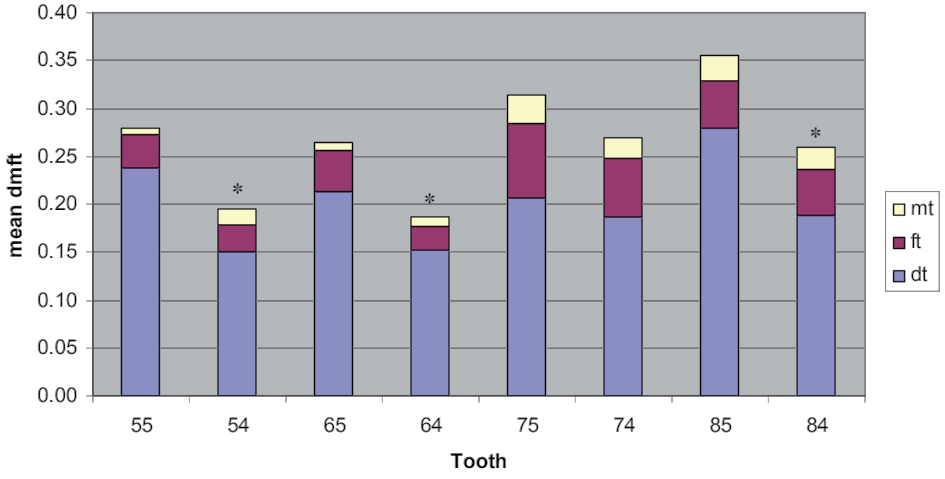

Figure 4.5: Mean dmft of the primary molars of Dutch 5-year-olds
* statistically significant difference between first and second primary molar (p<0,05)
mt = missing teeth
ft = filled teeth
dt = decayed teeth

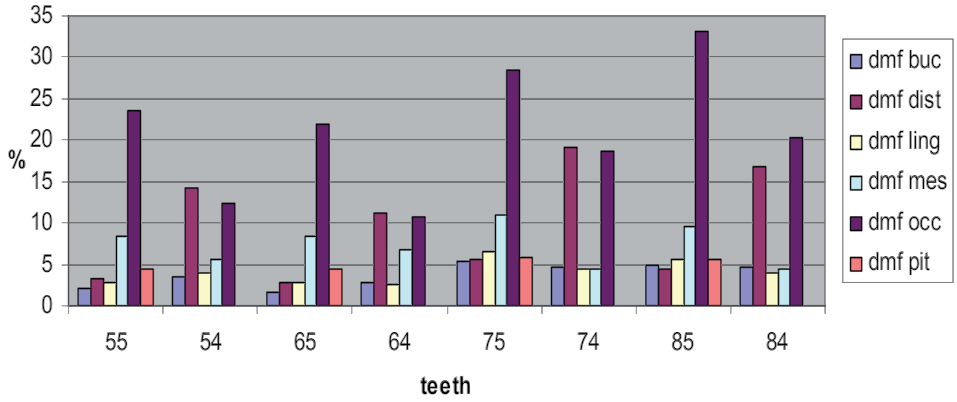

Figure 4.6: The proportion of primary molars scoring d (decayed), m (missing) and f (filled) per surface in Dutch 5-year-olds
dmf buc = decayed, missing or filled buccal surfaces
dmf dist = decayed, missing or filled distal surfaces
dmf ling = decayed, missing or filled lingual surfaces
dmf mes = decayed, missing or filled mesial surfaces
dmf occ = decayed, missing or filled occlusal surfaces
dmf pit = decayed, missing or filled surfaces in the buccal pit or palatinal groove of the second primary molar

DISCUSSION

The study population consisted of children insured by the Health Insurance Funds, possibly overrepresenting those with a lower social economic status in this sample. Differences in developmental enamel defects in the primary dentition between different social classes were not reported (18). Children from higher social classes are reported to have on average lower dmfs scores than those from lower classes (1). Moreover, as no radiographs were taken, caries lesions would have been underrecorded, up to a level of 60% (4). A biased sample of participants for the dental visit was not likely present as no differences between participants and non-participants were determined with regard to tooth brushing frequency, education level of the mother, and country of birth of mother and child. Caries was present in 56% of the children. The d-component constituted the major part of the caries index. This finding has been confirmed by earlier studies (7, 10, 19). This study confirms the reports of other studies that second primary molars have more caries than first primary molars (3, 7, 9, 10, 20). The anatomy of the tooth could also be an explanation for differences in caries between the first and second primary molar. In 1981, Bimstein et al. (21) investigated which tooth surface is most likely to develop caries. They reported 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 lower jaw and the palatinal fissure in the second molar in the upper jaw. As we recorded caries on these surfaces separately not including the

pits and fissures in the analysis, the tooth-anatomy is not a major explanation for the differences we observed. This conclusion is supported by other authors (11, 22). In this study, gender did not influence the prevalence of caries in second primary molars significantly, which is in line with other research (15, 23-27). Previous studies have reported that low parental education is associated with a greater prevalence of caries (23, 25, 26, 28), in contrast to this study in which the education level of the mother did not influence the caries differences in second primary molars. In most studies, 'brushing once a day' is chosen as the lower frequency cut-off point (15). In this study, only a few children (seven out of 240) brushed less than once a day, which may explain why we did not find a relationship between caries in second primary molars and the tooth brushing frequency. Brushing the second primary molar could be more difficult than brushing the first primary molar (11); however, Al-Malik et al. (5) stated that feeding pattern, toothbrushing and fluoride intake are very important for caries development and most likely comparable for first and second primary molars in the same oral cavity. It should be mentioned that there is no water fluoridation in the Netherlands, with the most common source of fluoride being toothpaste. The majority of participants (85%) brushed with fluoridated toothpaste. The parents of 5% of the participants did not know if the toothpaste contains fluoride or not. The most common advise in the Netherlands is to brush with toothpaste with a reduced fluoride concentration (500-750 ppm) until the age of 5, and children of 5 and that older should brush with a toothpaste with a fluoride concentration between 1000 and 1500 ppm (29). Studies on the influence of ethnicity of the child on caries prevalence are difficult to compare due to the different definitions of ethnicity (15). The study of Vanobbergen et al. (15) shows no differences between Belgian and non-Belgian 7-year-old children. In this study, the group of children not born in the Netherlands was too small to draw conclusions. In most studies, only the country of birth or the ethnicity of the child is looked at (15). But the country of birth of the mother can also influence the caries experience of the child. In the country of birth of the mother there could be, for example, different feeding habits. From this study, it can be concluded that the country of birth of the mother has influence on the caries in the second primary molars. More investigations are needed into how the country of birth influences caries. In this investigation, DMH is shown to be related to a higher dmft score in second primary molars in 5-year-old Dutch children. This study did not investigate the aetiological factors associated with the occurrence of DMH, however, this warrants further research. In the primary dentition, molars are the teeth most often affected by caries (3, 7, 11) and second molars are more often affected than first molars (3, 7, 11). A positive correlation between enamel hypoplasia and caries in the primary dentition was found in some investigations (13, 14, 30). As DMH is defined as hypomineralisation of 1-4 second primary molars (16), we did not look at possible hypomineralisations on the first primary molars in this study. In this investigation, it is shown that DMH is related to a higher dmft score in second primary molars in 5-year-old Dutch children. This study asks for further research on the influence DMH on the caries prevalence.

From this study, we conclude that DMH as well as the country of birth of the mother play a role in the prevalence of caries in the second primary molar. The aetiological factors associated with childhood dental caries need to be investigated further in longitudinal clinical trials.

What this paper adds

* This paper identifies Deciduous Molar Hypomineralisation as a factor influencing the prevalence of caries in second primary molars.

Why this paper is important to paediatric dentists

* Paediatric dentists should be aware of the factors influencing the prevalence of caries.
* Deciduous Molar Hypomineralisation can influence the caries pattern in the primary dentition.

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