The relationship between caries in the primary dentition at 5 years of age and permanent dentition at 10 years of age – a longitudinal study

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Summary. *Objectives.* To explore a possible relationship between the caries experience and pattern in the primary dentition at 5 years of age and the permanent dentition at 10 years of age. Further, to examine the possibility of predicting children in a caries-risk group at 5 years verified at 10 years of age.

Materials and methods. A sample of 186 children (90 males) were clinically examined as 5-year-olds and re-examined as 10-year-olds by calibrated dentists. A five-graded diagnostic system including enamel caries was used. Bitewing radiographs were taken. A true risk group of children at 10 years were defined as those with at least one dentin or filled lesion on the mesial surface of 6-year molars, and/or on incisors, and/or total DMFS (decayed, missing, and filled surfaces) more than 1 SD above the mean. The prediction was measured in terms of OR (odds ratio), sensitivity/specificity, and receiver operating characteristic curves.

Results. Statistically significant correlations ($r = 0.5$) were found between the caries experience in the two dentitions as well as between the primary second molars at baseline and the permanent teeth at 10 years. 'Primary second molars' and 'all primary molars' were the most powerful predictors for allocation into the risk group (24% of the sample). The highest achieved sum of sensitivity and specificity, 148%, was attained at a cut-off point above two carious surfaces in enamel and/or dentin in primary second molars.

Conclusions. Statistically significant relationship in disease between the dentitions was found. More than two surfaces with caries experience in primary second molars are suggested as a clinically useful predictor at 5 years of age for being at high risk at age 10.

Introduction

It is well established that the caries status in the young permanent dentition is related to the corresponding status in the primary dentition [1]. Nevertheless, this relationship is not sufficiently clear-cut for measurement of caries experience in primary teeth to fully predict new caries of permanent teeth. The potential caries promotive exposures time vary between dentitions [2] as does the range of interrelated factors acting in the caries process [3]. These make the ideal stability needed for prediction impossible. Within these limitations, when caries is established, past caries experience remains the most powerful known single predictor of future caries in the young permanent dentition [1,4].

However, many of the previous studies in this area suffer from obvious methodical weaknesses. Retrospective study designs are common, where for practical reasons baseline data have been obtained from previous records. In these cases reliability might be questioned, as prior inter-examiner calibration is usually lacking. By contrast, prospective longitudinal study designs allow the same diagnostic methods to be used and may include calibration training programs and the same caries criteria both at baseline and at the endpoint examination. This latter type of design is to be preferred, either when the focus is to look for caries associations between primary and permanent teeth at two points of time or to identify the children who might constitute a risk group in the future or both.

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There are also questions concerned with the validity of some previous study designs.

The diagnostic method chosen should be based on current scientific knowledge that dental caries is a complex multifactorial disease, resulting from a disturbance in the balance between teeth and existing oral flora present in biofilms. Those sites where biofilms are allowed to mature and remain especially favour new caries development [5]. The dynamics of the disease should therefore be included, reflecting all different stages from small white spot lesions to large cavities and teeth with extensive destructions [6]. Acceptable levels of inter-examiner reproducibility may now be achieved with detailed caries diagnostic criteria and provision of suitable training [7,8]. Previous authors have also focused on the predictive strength of incipient caries lesions [9,10]. It may therefore be stated that validity in predictive studies is reduced if initial lesions are excluded from the caries diagnoses. This typically occurs if X-ray examination is omitted [7,11].

The time span from 5 to 10 years covers a period where teeth of both dentitions coexist, sharing the exposures related to caries occurrence. The impact of these caries-promoting conditions has been described in detail by Mejàre *et al*. [12]. In view of the recent caries increase seen among Norwegian 5-year-olds [13], concern is emerging that this negative trend will in future years come to affect the permanent dentition. Primarily, this period is of outmost importance for the future health of the permanent first molars, these being the most caries-susceptible teeth in the young permanent dentition [14,15]. The approximal surfaces (mainly the mesial surfaces up to 10 years of age) are especially prone to caries onset and progression up to 5 to 6 years after the eruption [14]. These surfaces are particularly refractive towards preventive strategies [16].

Insight into disease in this specific period, contributing to a drop in the number of restorations of permanent first molar, would benefit dental health in child, adolescent, and adult. Prevention of mesial surface restorations would save considerable tooth substance and simultaneously reduce life-long need of restoration replacement [17]. It is also noteworthy that the age period up to 10 years is one where initiation and onset of dental anxiety may occur as a result of negative experience during restorative treatment [18]. If invasive operative treatment could be avoided during this period, the prevalence of dental anxiety might as well be reduced.

It may be concluded from past research that not only is the identification of high caries-risk individuals important in itself, but also that the identification of those children with distinct caries pattern is of value, as these individuals are likely to need invasive restorative treatment in future.

The aims of this prospective, longitudinal study were therefore (1) explore a possible relationship between the caries prevalence and pattern in the primary dentition at 5 years of age and the permanent dentition at 10 years of age, and (2) examine the predictive power of caries experience at 5 years for identifying children most likely to develop a severe caries pattern in the permanent dentition at 10 years of age (risk group).

Methods

Study design

This was a prospective, longitudinal study based on two caries examinations of the same children at 5 and 10 years of age, respectively, living in the city of Bergen, Norway.

Subjects

The whole cohort was composed of children who attended three clinics of Public Dental Health Service (PDHS) where they were offered annual check-ups and treatment free of charge from 3 years of age. The first examination included in this study took place when they were 5 years of age in 1993 ($n = 217$, 108 males) and the second when they were 10 in 1998 ($n = 186$, 90 males). Moving and unwillingness to participate were the main reasons for drop-outs ($n = 31$, 18 males), these latter children failed to respond to several attempts to a recall. The catchment area was intended so as to include children from a variety of socio-economic backgrounds. When analysed, however, the parental educational level showed to be above the mean for the general population [19,20].

Examiners

At baseline, five dentists examined the 5-year-old children, whereas this was done by only one when the children were 10 years of age. To achieve high inter-examiner reproducibility, a calibration program for the examiners was performed before the study began, consisting of both radiographic and clinical

training sessions. A group of 20 patients, randomly selected, were re-examined by each examiner, and measurements of the intra- and inter-examiner reproducibility were based on these repeat clinical examinations. The Cohen's kappa values obtained have been published previously (ranging from 0·62 to 0·90) [7,20].

Caries examination

The procedure that followed caries examination, as well as the caries diagnostic system chosen, was the same at both baseline and endpoint sessions. Before carrying out the clinical examinations, teeth were polished with prophylactic paste and dried with air and cotton rolls. Good lighting, using operating lights, was used for clinical examinations, and at each examination bitewing radiographs were taken whenever the approximal surfaces of molars could not be inspected clinically.

The caries diagnostic system used was detailed, using 5 caries grades (from 1 to 5) from outer enamel to inner dentin [7]. A fissure sealant on occlusal surface was counted as sound surface, this is in contrast to a preventive resin restoration, which was registered as filled. When there was doubt about the type, distinction was made by checking dental records. Extracted teeth or teeth indicated for extractions (except for orthodontic reasons) were counted as two affected surfaces in the dmfs/DMFS (decayed, missing, and filled surfaces) index. Teeth restored because of trauma were registered as sound. Baseline caries data and the caries increment in the primary dentition during the follow-up period of 5–10 years have been published previously [20,21].

Risk group

A risk group of children at age 10 was defined according to the caries status of the permanent teeth where the severity of the caries lesions, the surface type (prone to invasive operating treatment), and total caries experience were considered. Children included in the risk group were those with (1) one or more dentin or filled lesions on the mesial surface of 6-year molars, and/or (2) same type of lesions on any incisor, and/or (3) total $D_{1-5}MFS$ more than 1 SD above the mean. Erupted premolars and permanent second molars were not included in the calculation of the risk group, as these teeth were not present in a majority of the children. The clinical

practice in PDHS with respect to criteria for operative caries treatment is in most cases to wait until the lesions reaches the dentin [22].

Ethical approval

A written, informed consent was obtained from all parents before the study. The investigation was also approved by the Regional Committee for Medical Research Ethics and the Norwegian Data Inspectorate.

Statistical methods

Analyses were performed by the SPSS (Statistical Package Social Sciences) version 11·0 (SPSS, Inc. Chicago IL).

Data on caries prevalence in the permanent dentition included all erupted teeth, but only the permanent first molars and incisors were used in the analyses of prediction. Chi-squared statistics and independent-sample *t*-tests were used for measuring differences between groups of children. To assess the associations between caries experience in the two dentitions, Spearman's rank correlation coefficient was used. A logistic regression model was constructed to measure at the age of 5 years the probability of predicting inclusion the risk group at 10 (dichotomous dependent variable). A number of possible predictors (independent variables) were tested, and were given the value 1 for an expected positive relationship and 0 if not. Statistically significant predictors from bivariate regression were included in a multivariate stepwise logistic regression model. To identify the potentially best predictors, the measures were based on values from regression analyses (odds ratio (OR) values), values of sensitivity, specificity, positive and negative predictive values, proportion of children correctly classified (crude hit rate), and ROC (the receiver operating characteristic) curves. Areas beneath ROC curves were calculated using SPSS.

The level of statistical significance was set at 5%.

Results

Caries prevalence in the permanent teeth at 10 years of age

Caries experience at 5 years ($d_{1-5}mft$ – decayed, missing, filled teeth) among the group who were lost

Table 1. The caries prevalence at tooth level (D_{1-5}MFT) in permanent teeth at 10 years of age.

	Mean (SD)
D_{1-2}T	1·47 (1·54)
D_{3-5}T	0·35 (0·84)
FT	0·61 (1·07)
MT	0·00
D_{1-5}MFT	2·43 (1·97)

D_{1-2}: enamel lesions, D_{3-5}: dentin lesions.

to the study by the age of 10 did not differ from the study group at baseline (drop-outs 3·94, SD = 3·22 vs. follow-up group 3·74, SD = 4·02, $t = 0·262$, $P = 0·794$).

At 10 years of age, all incisors, 36·6% of the canines, 23·7% of premolars, all permanent first molars, and 3·6% of the permanent second molars had erupted.

D_{1-5}MFT was 2·43 (SD = 1·97) and D_{1-5}MFS was 3·52 (SD = 3·47), ranging from 0 to 18 surfaces. Tables 1 and 2 give further details of the caries distribution and severity. No statistically significant sex difference in D_{1-5}MFS was found.

Frequencies

The percentage of caries-free children (D_{1-5}MFS = 0) amounted to 24·7% ($n = 46$). Almost 71% (70·9%)

of all caries were found in 33·8% of the children when incipient caries was included (D_{1-5}MFS). When only manifest caries (D_{3-5}MFS) was considered, the same percentage (70·9%) of the caries burden affected 17·2%. No extractions were reported. Dentin caries and/or filled lesions (D_{3-5}MFS) affected 41·9% of the children ($n = 78$).

The permanent first molars had the highest portion of the caries burden (91·8% of D_{1-5}MFS). A total of 45·7% ($n = 85$) of the children had one or more mesial caries lesions (D_{1-5}MFS) in the permanent first molars at the age of 10, whereas 12·9% ($n = 24$) had at least one dentin lesion (D_{3-5}MFS) on these surfaces. Out of all mesial lesions (D_{1-5}FS) 61·6% belonged to 17·2% of the children. Sixty-one children (32·8%) had caries on all four permanent first molars, whereas 27 (14·5%) had three affected molars.

Seventeen children (9·1%) had at least one caries lesion in the permanent incisors (D_{1-5}MFS), seven (3·8%) of them had manifest or filled caries lesions (D_{3-5}MFS). The canines were caries free (D_{1-5}MFS = 0) in all individuals.

Relationship between caries in the primary teeth at 5 years of age and caries in the permanent dentition at 10 years of age

A statistically significant correlation was found between caries in the primary dentition at 5 years

Table 2. The caries prevalence and distribution at surface level (D_{1-5}MFS) in permanent teeth at 10 years of age.

Surfaces	D_{1-2}S Mean (SD)	D_{3-5}S Mean (SD)	FS Mean (SD)	D_{1-5}MFS Mean (SD)
Incisors (100% present)				
Approximal	0·06 (0·30)	0·02 (0·16)	0·02 (0·13)	0·10 (0·46)
Buccal/lingual	0·05 (0·37)	0·01 (0·10)	0·01 (0·15)	0·07 (0·41)
Canines (36·6% present)				
Approximal	0·00	0·00	0·00	0·00
Buccal/lingual	0·00	0·00	0·00	0·00
Premolars (23·7% present)				
Approximal	0·03 (0·22)	0·00	0·00	0·03 (0·22)
Buccal/lingual	0·00	0·00	0·00	0·00
Occlusal	0·02 (0·18)	0·01 (0·07)	0·00	0·03 (0·19)
1. Permanent molar (100% present)				
Approximal	0·82 (1·16)	0·11 (0·41)	0·09 (0·38)	1·02 (1·41)
Buccal/lingual	0·45 (0·86)	0·09 (0·35)	0·22 (0·60)	0·76 (1·12)
Occlusal	0·82 (1·26)	0·15 (0·42)	0·49 (1·04)	1·46 (1·58)
2. Permanent molar (3·6% present)				
Approximal	0·00	0·00	0·00	0·00
Buccal/lingual	0·00	0·01 (0·15)	0·00	0·01 (0·15)
Occlusal	0·03 (0·25)	0·02 (0·16)	0·00	0·05 (0·36)
Total				3·53 (3·48)

D_{1-2}: enamel lesions, D_{3-5}: dentin lesions.

of age (d_{1-5}mfs) and in permanent teeth at 10 years of age (D_{1-5}MFS) ($r = 0.5$, $P < 0.01$). Exactly the same correlation ($r = 0.5$, $P < 0.01$) was obtained between caries in all the primary second molars at baseline and caries in the permanent dentition, whereas the correlation between caries in primary first molars and in the permanent dentition was 0.4 ($P < 0.01$).

Among children with no caries at baseline ($n = 57$), 61.4% ($n = 35$) had caries in their permanent dentition by 10 years of age, whereas this was the case for 81.4% ($n = 105$) of the children with caries experience at 5 ($n = 129$) ($\chi^2 = 8.49$, $P = 0.004$). The great majority (92.2%, $n = 71$) of children with dentin and/or filled caries lesions and/or extractions at baseline had also caries in the permanent dentition at 10 years of age.

Risk group: children with the most severe caries patterns in the permanent dentition

The risk group defined at 10 years of age comprised of 19 boys and 26 girls, constituting 24.2% of the sample. The mean D_{1-5}MFS among this group was 7.96 (SD = 3.28) and the mean D_{3-5}MFS was 3.36 (SD = 3.04). Thirty-three children (33/45, 73.3%) had a D_{1-5}MFS higher than 1 SD above the mean of the whole sample, whereas seven children
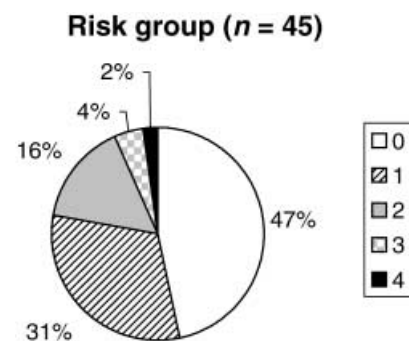

Fig. 1. Distribution of the children in the risk group according to their number of dentin lesions and filled caries surfaces on the mesial surface of the permanent first molars.

(7/45, 15.5%) had manifest caries (D_{3-5}MFS) in their incisors. The distribution of children according to their number of carious dentin lesions and filled surfaces on the mesial surface of the permanent first molars is shown in Fig. 1.

The relationship between potential caries risk markers at 5 years of age and inclusion in the risk group, based on models of logistic regression, is shown in Table 3. The variable 'primary second molars', showed the highest odds ratio (OR = 12.3). This was also the only variable left in the model after the final multiple stepwise regression analysis with inclusion in the risk group as the dependent variable.

Table 3. Results of the logistic regression analyses: Independent variables (possible predictors) at 5 years of age found to be significantly related to assignment to the risk group at 10 years of age.

Bivariate regression Baseline variables	*n*	% in target group	Odds ratio	95% CI	*P*	R-square
At least one caries lesion, d_{1-5}fs, in primary second molars						
Yes = score 1	Yes 117	35.9	12.3	3.6–41.6	< 0.001	0.21
No = score 0	No 69	4.3				
At least one caries lesion, d_{1-5}fs, in all primary molars						
Yes = score 1	Yes 126	33.3	9.5	2.8–32.1	< 0.001	0.16
No = score 0	No 60	5.0				
At least one approximal caries lesion, d_{1-5}fs, in primary first molars						
Yes = score 1	Yes 73	39.7	4.0	2.0–8.1	< 0.001	0.12
No = score 0	No 113	14.2				
At least one approximal caries lesion, d_{1-5}fs, in all primary molars						
Yes = score 1	Yes 81	37.0	3.5	1.7–7.2	< 0.001	0.10
No = score 0	No 105	14.3				
At least one approximal caries lesion, d_{1-5}fs, in primary second molars						
Yes = score 1	Yes 67	38.8				
No = score 0	No 119	16.0	3.3	1.7–6.7	= 0.001	0.09
At least one caries lesion, d_{1-5}fs, in primary first molars						
Yes = score 1	Yes 92	34.8				
No = score 0	No 94	13.8	3.3	1.6–6.9	= 0.001	0.09
Multiple regression (same independent variables).						
At least one caries lesion, d_{1-5}fs, in primary second molars						
Yes = score 1	Yes 117	35.9	12.3	3.6–41.6	< 0.001	0.21
No = score 0	No 69	4.3				

Table 4. Predictive values of assignment to the risk group at 10 years of age.

	TP	FP	TN	FN	Se (%)	Sp (%)	Pv+ (%)	Pv– (%)	PHR (%)
Baseline d_{1-5}fs, primary molars x									
> 0	42	84	57	3	93	40	33	95	67·7
> 1	39	69	72	6	87	51	36	92	58·1
> 2	38	53	88	7	84	62	42	93	48·9
> 3	35	46	95	10	78	67	43	90	43·5
> 4	29	39	102	16	64	72	43	86	36·6
> 5	25	29	112	20	56	79	46	85	29·0
Baseline d_{1-5}fs, primary second molar xx									
> 0	42	75	66	3	93	47	36	96	62·9
> 1	39	60	81	6	87	57	39	93	53·2
> 2	34	40	101	11	76	72	50	90	39·8
> 3	26	35	106	19	58	75	43	85	32·8
> 4	14	23	118	31	31	84	38	79	19·9
> 5	7	15	126	40	15	89	32	77	11·8

True positive (TP), false positive (FP), true negative (TN), false negative (FN), sensitivity (Se), specificity (Sp), predictive positive value (Pv+), predictive negative value (Pv–), portion children at risk (PHR).

Predictive power

The predictive power values for inclusion the risk group of five different cut-off points of caries (d_{1-5}fs) in 'the primary second molars' only and 'all primary molars' are shown in Table 4. The highest sum of sensitivity and specificity (148%) was gained when the predictor was more than two lesions in 'primary second molars'. At this cut-off point the sensitivity was 76%, and 73% of the children were correctly classified. More than two lesions were also the cut-off point when the sum of sensitivity and specificity of 'all primary molars' reached its highest value (146%).

The ROC curves, drawn in Fig. 2, are based on the data of sensitivity and specificity in Table 4. This graphical approach is used to compare the predictive power between different predictors, by measuring the areas under the respective curves. These areas were found to be almost equivalent for the two predictors. A_1 of 'primary second molars' was 0·75, CI = 0·67–0·82, whereas A_2 of 'all primary molars' was 0·76, CI = 0·69–0·84.

Discussion

Because the educational level of the parents of the children in the present sample was above the mean of the general population, the findings cannot be fully generalized to the Norwegian children population [19]. However, the proportion of 5-year-old children in the present sample with d_{3-5}fmt = 0 in 1993 was found to be comparable to the national data of
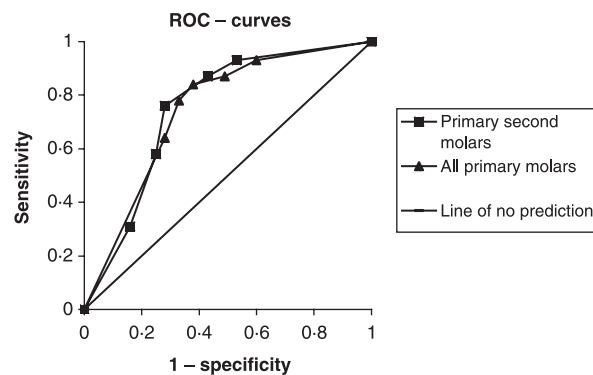
Fig. 2. Receiver operating characteristic (ROC) curves based on data presented in Table 4. The diagonal implies no diagnostic predictive value, while the area under each curve represents the predictive power of the respective predictors.

the current age group [19]. There are also reasons to argue that representativeness is of less importance in a longitudinal study compared to one of cross-sectional design, as long as the distribution of caries in the sample is reasonably similar to that in the general population.

In Norway annual caries prevalence data (D_{3-5}MFT) are reported nationally and regionally for specific child groups, although not for 10-year-olds. Sixty percent of the children closest in age (12-year-olds) were reported to have a D_{3-5}MFT of 1·9 in 1998 [23], an estimate higher than in the present study group as might be expected because of the difference in age. A study from Germany of 210 10-year-old children reported that 52·2% had caries (dentin lesion criteria) with a mean DMFT of 1·2

(SD 1·4) [24]. Another study from Finland (66 children) assessed DMFT (WHO criteria) from low and high sucrose intake groups to be 0·5 (SD 1·1) and 1·4 (SD 2·0), respectively [25]. These Nordic data were in agreement with the $D_{3-5}MFT$ seen in the present study group. Furthermore, the cumulative caries frequency distribution found in the present study showed the typical trait of skewness, which is now characteristic for distribution of caries among children [26,27]. All these observations of the study group's similarity to population data are reassuring, since they suggest that the distorting 'baseline effects' seen in longitudinal studies without randomization are not too dominant. In this study missing data were not thought to have biased the results either, as no statistically significant difference was seen in caries experience between the drop-out and the study groups. However, the relative small sample size may constitute a limitation in the study.

A consequence of discrepancy in timing of both tooth emergence and exfoliation [28,29], is that the tooth-specific times of being at risk differed between individuals. Undoubtedly, omission of available time-to-event statistical methods dealing with caries as an individual time-dependent process [30] is a study weakness and should be taken into account. However in this study, this factor was partly accounted for by including in analyses only those tooth groups with all teeth erupted at the age of 10.

The time period chosen has been less covered by previous longitudinal studies despite the fact that it is an important period for children's future relationship towards dental health services. The well-documented positive relationship between caries in the primary and young permanent dentitions makes this period particularly important for planning and implementation of caries preventive strategies. This challenging task requires detailed knowledge of caries prevalence and increment in both dentitions. Furthermore, in light of concern about increasing caries prevalence among 5-year-old children [13], this age period is also important if the same trend is not to be carried into the future. It is therefore discouraging that some dental health authorities give low priority to treatment of primary teeth [31,32]. This may lead to a general acceptance of decay in primary teeth among the population, as is already seen among parents of some non-Western cultures [33]. With an increasing influx of immigrants [34], this problem needs to be actively addressed.

Previous studies have revealed that the caries increment during this age period is high, resulting in extensive need for treatment of primary teeth [20,35]. There are a variety of external explanatory factors for this that may include fading parental control, increasing access to money, vulnerability to advertising, and peer influence [36]. Also the current trend towards more democratic attitudes within the family unit [36] has contributed to the fact that children of this age group now spend more money on sweet snacks than ever before [37]. Supervised tooth brushing as routine dental behaviour might also be less frequent during these years, as a result of the increasing independence of the children as they grow older.

Different considerations were taken into account when constructing the risk group, thus making it more challenging than the more traditional caries/no caries design (any risk model). First, to endeavour a low level of 'misclassification' of risk group children, the selection criteria were primary based on rather crude measurements [38]. Additionally, the awareness of possible bias associated with the practice of sealing permanent first molars shortly after eruption influenced the selection criteria [39,40]. Efforts were also made to make the size of the group to represent a recommended range regarding practicality and to be cost-effective for preventive care [41]. These are important considerations in times of decreasing resources in most national health-care systems [24].

As expected and in line with previous consistent reports [1], caries experience in the two dentitions was shown to be significantly related. Caries in 'primary second molars' ($d_{1-5}mfs$) as predictor showed the highest OR value in the logistic regression analyses, followed by caries in 'all primary molars'. These findings were the consistent result emerging from a multitude of analyses, in which various tooth groups, surfaces, caries graded severity, or other constructed combinations were tried out as possible predictors. The high correlation values between caries in the primary molars and the young permanent dentition strengthened the finding of primary molars' impact on permanent teeth. In accordance with findings in previous literature reviews, the caries status of the most recently exposed surfaces is the most appropriate measure of past caries development [1]. In the primary dentition, the primary molars should therefore be the appropriate choice.

When the cut-off point level for caries risk is increasing, with decreasing group size as a result,

the sensitivity is reduced and the specificity increased. At cut-off points above two lesions the primary molars reached the highest sum of sensitivity and specificity ('primary second molars': 148%, 'all primary molars': 146%). The highest attained sum (148%) did, however, not reach a suggested minimum acceptable level of 160% [42], but it was found identical to the average sum, based on multifactorial prediction models in a literature review [1]. According to Hausen [43], few studies with the size of a risk group within the range 20–30% have attained sensitivity values above 60%. Therefore the sensitivity achieved by 'primary second molars' when the threshold was above two lesions may be classified as reasonably powerful (76%) [2,41]. The proportion of children correctly classified (crude hit rate), found using this predictor (73%), is almost similar to another Finish study covering the age span [44].

Seen in the light of the relative long period studied here, the particular age span, the reasonable size of the high-risk group, and the fact that no combination of predictors beyond past caries experience were chosen, these results might be estimated as 'almost acceptable'.

The difference between the predictive areas of the two analysed predictors, illustrated by the ROC diagrams, is negligible. From a clinical point of view it might be suggested more practical to use the number of caries lesions in the four primary second molars instead of including all eight molars. This focus on primary second molars for future health of permanent teeth is in line with the findings of Mejàre and Stenlund [14], who found that the distal surface caries status of the actual teeth affected the mesial surface of permanent first molars.

It is therefore concluded that more than two surfaces with caries in 'primary second molars' may be a clinically useful predictor at 5 years of age for the group for future caries development in the next 5 years on permanent incisors, and/or on mesial surfaces of permanent first molars, and/or as a whole develop an extensive amount of lesions in permanent teeth (1 SD above the mean). By using these results a practitioner can inform the child and parents at an early age which surfaces are in need of special hygiene attention and explain that restorations still might be avoided, if these sites are given appropriate dental care.

Any opportunity of combining this predictor with other known risk factors should be considered, as several predictors usually provide a more efficient prediction than one [4]. However, up to now, no high-risk strategy program has shown to be fully successful [45], and the high-risk preventive strategy should still be seen as a supplementary approach to the main population approach.

What this paper adds
- More detailed information about caries experience in the permanent dentition in 10-year-old children, according to caries severity and location on teeth and surfaces.
- Grading in strength of association between caries patterns in primary and permanent dentition from 5 to 10 years of age.
- Evaluation of past caries experience predictors at 5 years of age for identification of children at risk for distinct severe caries pattern at 10 years of age.

Why this paper is important for paediatric dentists
- Basis for planning caries prevention and treatment in children during the specific period from 5 to 10 years of age.

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