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Prevalence and risk factors of erosive tooth wear in 3–6 year old German kindergarten children—A comparison between 2004/05 and 2014/15

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ABSTRACT

Objectives: The aims of this study were (1) to investigate prevalence, severity and distribution of erosive tooth wear in German kindergarten children aged 3–6 years in 2014/15 in comparison to an earlier survey from 2004/05 and (2) to identify and compare possible risk factors.
Methods: 775 children aged 3–6 years from 27 kindergartens were examined in 2014/15 and compared to the data from 2004/05 (432 children/21 kindergartens). Erosive tooth wear was examined using the O'Sullivan-Index. Additionally, data were converted into the Basic Erosive Wear Examination (BEWE)-index. Information about dietary habits, chronic illness and oral hygiene practices were obtained by questionnaires. Statistical analyses were done by Chi^2-, Mann-Whitney *U* Tests and regression analyses ($p < 0.05$).
Results: Compared to 2004/05 (31.3%) prevalence of erosive tooth wear was significantly increased in 2014/15 (45.4%). In 2004/05 and 2014/15, prevalence increased significantly with increasing age of the children: 3-year-olds: 22.5%/14.2%; 4-year-olds: 27.4%/32.9%; 5-year-olds: 30.5%/58.8%; 6-year-olds: 38.1%/71.7%. Children with erosive tooth wear presented more affected teeth and a higher severity of erosive tooth wear, respectively, in 2014/15 compared to 2004/05. The BEWE score sum was significantly higher in 2014/15 (3-year-olds: 3.4 ± 2.1, 4-year-olds: 4.2 ± 3.1, 5-year-olds: 4.6 ± 2.9, 6-year-olds: 5.9 ± 3.3) than in 2004/05 (3-year-olds: 2.0 ± 1.2, 4-year-olds: 2.7 ± 1.8, 5-year-olds: 2.7 ± 2.4, 6-year-olds: 4.2 ± 4.2). In 2014/15, age and male gender were significant with respect to the presence of erosive tooth wear. Severity of erosive tooth wear was dependent on the regular consumption of fruit juices and lemonade/coke.
Conclusion: The prevalence of erosive tooth wear in German kindergarten children has increased in the last ten years.

1. Introduction

Erosive tooth wear is frequently seen in the primary and permanent dentition and seemed to increase over the last decades. Epidemiological studies have shown that up to 80% of children in the primary dentition and up to 100% of adolescents and adults in the permanent dentition present signs of erosive tooth wear (for review see Ref. [1]). However, prevalence data vary widely and are difficult to compare, not least as different scoring systems were used and different populations and number and sites of teeth were examined [1,2].

Thus, it is difficult to determine if the occurrence and severity of erosive tooth wear really increased over time or if the condition is perceived more often, for instance due to a growing knowledge about erosive tooth wear.

Only few studies investigated the prevalence of erosive tooth wear in the primary dentition over time with the same methodological standards. Ganss et al. [3] analysed the prevalence and incidence of erosive tooth wear by pre-orthodontic study models and found that the percentage of subjects with at least one tooth exhibiting erosive tooth wear in the primary dentition increased from 52.2% in the time period 1977–1989 to 83.1% in

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1990–1999. However, a recent study in Brazilian preschool children found very similar prevalences of erosive tooth wear when comparing data from 2008 (51.6%), 2010 (53.9%) and 2012 (51.2%) [4].

As data on prevalence changes are scarce, the purpose of this study was to compare prevalence, severity and distribution of erosive tooth wear in German kindergarten children aged 3–6 years in 2004/05 [5] and 2014/15 and to identify trends of this condition and investigate possible reasons for change.

The null hypotheses was that the prevalence of erosive tooth wear is not significantly changed within the past decade.

2. Methods

The present study was performed between December 2014 and May 2015 in the city of Göttingen, Germany, using the same methods and criteria as in the study performed in 2004/05 [5].

Ethical approval was given by the local ethics committee (08/11/14). Written consent was obtained from parents or legal guardians of the children before enrollment in the study. The study was conducted in accordance to the Declaration of Helsinki.

2.1. Sample population

All urban kindergartens (n = 62, approximately 2800 children) in Göttingen, Germany, were approached by the head teachers to participate in the study. Twenty-seven kindergartens agreed to participate and were involved in the study. From these kindergartens, 775 children (370 female, 405 male) aged 3–6 years were included in the study as they were allowed to participate (written consent) and cooperated at the day of examination.

2.2. Clinical examination

Examination of the children in the 2014/15 survey was conducted in the kindergartens with the child seated in the front of the examiner and using standardized light and dental mirrors. Erosive tooth wear was scored according to the O'Sullivan-Index [6] (as in the 2004/05 survey). Therefore, all teeth of the mouth were examined for site of erosion (A: labial or buccal only, B: lingual or palatinal only, C: occlusal or incisal only, D: labial and incisal/occlusal, E: lingual and incisal/occlusal, F: multi-surafce), severity (0: normal enamel, 1: matt appearance of the enamel surface with no loss of contour, 2: loss of enamel only/loss of surface contour, 3: loss of enamel with exposure or dentin/EDJ visible, 4: loss of enamel beyond EDJ, 5: loss of enamel and dentin with exposure of the pulp, 9: unable to assess) and area of surface affected (-": less than half of the surface affected, +": more than half of the surface affected) given a three-digit score. Generally, loss of surface contour appearing flat and shiny was defined as mechanical tooth wear (abrasion, attrition) and and was excluded from the analysis.

Additionally to the O'Sullivan-Index, the Basic Erosive Wear Examination (BEWE) [7] was used in n = 33 children to analyse if the conversion from the data of the O'Sullivan-Index [6] into the BEWE [7] (Table 1) is valid. BEWE-scores based on calculation from the data of the O'Sullivan-Index were compared to the pure BEWE data; weighted Cohens's Kappa statistics amounted to 0.969 (inter-test reliability).

Table 1
Corresponding values of BEWE and O'Sullivan Index.

BEWE	O'Sullivan	
Score	Severity	Area of surface affected
0	0	–
1	1, 2	
2	3, 4, 5	Less than 50%
3	3, 4, 5	More than 50%

For the basic erosive wear examination (BEWE), all teeth are examined and the most severely affected surface (buccal/facial, occlusal, and lingual/palatal) of each tooth is recorded (0: no erosive tooth wear, 1: Initial loss of enamel surface texture, 2: Distinct defect, hard tissue loss less than 50% of the surface area, 3: hard tissue loss more than 50% of the surface; in score 2 and 3 dentin is often involved) given the score for the respective tooth. Each tooth is scored, and the highest score for a tooth surface gives the score for each sextant. The BEWE score sum is calculated by adding the sextant scores.

Dental examinations in 2014/15 were undertaken by a single examiner (CMP) who was intensively trained and calibrated by an experienced examiner (AW, single examiner in the 2004/05 survey). To validate the calibration process, inter-examiner reliability (examination of 53 children) and intra-examiner reliability (examination of 33 children) was assessed with Cohen's Kappa statistics and amounted to 0.851 and 0.753, respectively.

2.3. Questionnaire

Questionnaires were given to and filled out by the parents/legal guardians along with the invitation letter and informed consent forms. The questionnaire consisted of a combination of open and close-ended questions regarding chronic illness related to gastric acid reflux or vomiting, erosion-related medications, dietary habits and oral hygiene habits [5].

Additionally, the leading teachers of each kindergarten were asked to fill out a questionnaire regarding dietary habits and oral hygiene measures in the institution.

2.4. Statistical analysis

Children were affected from erosive tooth wear when they had at least one tooth presenting signs of erosive tooth wear. Chi^2-tests were performed to compare the prevalence of erosive tooth wear in 2004/05 and 2014/15 and to test the influence of age and sex on erosive tooth wear. To analyse if the number of teeth affected from erosive tooth wear has increased, Mann-Whitney *U* test was applied (all tests based on the O'Sullivan-Index [6]).

To analyse if severity of erosive tooth wear (BEWE score sum) has increased from 2004/05 to 2014/15, Mann-Whitney *U* test was applied. Therefore, data were transferred from the O'Sullivan Index [6] into the BEWE scoring system [7] (Table 1) as the inter-test reliability showed a very high agreement (weighted Cohen's Kappa: 0.969).

For the data of 2014/15, logistic regression analysis was performed to identify risk factors for erosive tooth wear; odds ratios for risk factors were calculated. Stepwise regression was applied to identify risk factors that influence the severity of erosive tooth wear (based on BEWE score sum).

Overall, a p-value < 0.05 was considered to indicate statistical significance.

3. Results

3.1. Prevalence, severity and distribution of erosive tooth wear

Compared to 2004/05 (31.3%) prevalence of erosive tooth wear in 3–6 year old children was significantly increased in 2014/15 (45.4%). Prevalence of erosive tooth wear differed significantly between 2014/15 and 2004/05 for 5- and 6-year old children, but not for 3- and 4-year old children. However, in both surveys (2004/