Erosions in younger adults in Germany: results of the 6th German Oral Health Study (DMS • 6)

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Objectives: In addition to caries, other dental hard tissue diseases, such as erosive wear, are gaining importance in prevention and treatment. The survey aimed to collect current data on the prevalence of erosions in younger adults and to compare these with the previous state of knowledge. **Method and materials:** As part of the representative 6th German Oral Health Study (DMS • 6), all teeth were assessed according to the basic erosive wear examination (BEWE). The maximum value of the findings per sextant was included in the evaluation. **Results:** The prevalence of erosions was found to be 43.2%. At 49.1%, men had significantly more erosions than women (37.8%). Younger adults with a high education status were affected by erosions more frequently than persons with a medium or low education status (49.2%, 37.9%, and 45.1%, respectively). **Conclusion:** The prevalence of erosions remains practically unchanged from the Fifth German Oral Health Study (DMS V) of 2014. However, the proportion of people at increased risk has risen sharply. The continued high prevalence of erosions combined with the increased proportion of people with a medium or high risk classification indicates that the prevention and treatment of erosive wear is a clinically relevant issue. *(Quintessence Int 2025;56(Suppl): S76–S81; doi: 10.3290/j.qi.b5982008)*

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The success of oral prevention in Germany is also reflected in younger adults, with a decline in their caries experience and, in particular, with a higher number of caries-free teeth.[1] However, this increases the likelihood of the teeth suffering from non-carious changes. This includes development-related tooth anomalies, but also various forms of tooth defects acquired over time, such as erosions. Dental erosion is defined as the loss of dental hard tissue due to the direct effect of acids without bacterial involvement.[2,3] The defects initially form in the enamel and then progress into the dentin. The source of the acids is mostly food and drink. Gastric acid is another factor that can result in large erosive losses in the tooth structure.[2,3] Details on the etiology of erosive wear can be found in reviews.[3,4]

Abrasions have a different etiology. As a result of mechanical influences such as habitually brushing the teeth too vigorously, they can occur as wedge-shaped defects in the cervical tooth region.[2] Hard tooth tissues that have been softened by erosion are lost more quickly to abrasion. This results in defects whose etiology is based both on acid action and on mechanical effects.[5] In their pure form, erosions have a trough-like shape with rounded curvatures at the transition of the defect to the surrounding tooth tissue.[6] Abrasions from brushing, in contrast, are marked by sharp angles at the transition to neighboring, unaffected tooth surfaces and at the base of the lesion. In everyday clinical practice, however, the shape of the defect often does not allow clear conclusions as to its erosive or mechanical origin.

The prevalence of erosions in younger adults globally is stated to vary widely from 4% to 100%.[7] The previous German Oral Health Studies (DMS) provide nationally representative data for Germany. For the DMS V in 2014, a prevalence of 44.8% was determined for 35- to 44-year-olds, while the DMS III in 1997 stated a lower prevalence of 27.2%.[8,9]

The present analysis intended, based on the epidemiologic findings of the 6th German Oral Health Study (DMS • 6), to update the figure for the prevalence of erosions in younger adults, to analyze the severity of the defects, and to compare the findings with previous investigations.

Method and materials

The general methodology of the study is presented in separate articles.[10,11] The DMS • 6 has been approved by the Institutional Review Board (IRB) of the Witten/Herdecke University, Witten, Germany (registration number S-249/2021). This study is registered at the German Clinical Trials Register (registration number DRKS00028701).

Sample

A total of 924 adults were included in the analysis. In four younger adults from the DMS • 6 analysis set, the presence of erosions could not be recorded because they were either edentulous (n = 1) or had no tooth surfaces without clinical findings such as caries or restorations. Therefore, no tooth surface was available for diagnosis (n = 3).

Measurement methods and variables

Erosions were recorded using simple recording in accordance with the basic erosive wear examination (BEWE).[12] All teeth without a clinical finding, as well as teeth with fillings or partial crowns/inlays, were assessed for erosion in a separate recording sequence. The index differentiates between initial loss of surface structure (score 1) and clinically manifest erosions of less or more than 50% of the most affected tooth surface (scores 2 and 3). The extension of the defect into the dentin generally found in scores 2 and 3 was not specified as a gradation criterion.

For the survey, the main symptom used to determine more advanced erosive hard dental tissue loss was defined as a trough-shaped clinical appearance with rounded curvatures. If the erosive defects in part showed sharp ridges at their edges or bottom, which indicate the superposition of erosive and mechanical effects, these mixed forms of erosion and other defects were also recorded and registered in accordance with the BEWE. Exclusively wedge-shaped defects, in contrast, were not recorded.

The erosions were assessed tooth by tooth, with the most severe finding per sextant being recorded. In line with the BEWE, a risk classification was derived from the sum of the values for all sextants:

- score sum 0 to 2: no increased risk level
- score sum 3 to 8: slightly increased risk level
- score sum 9 to 13: medium risk level
- score sum 14 to 18: high risk level.

Statistical analysis

A descriptive analysis of the prevalence, a risk level classification (BEWE), and an analysis of the distribution of the BEWE maximum scores were carried out. For the epidemiologic description, prevalences with associated 95% confidence intervals (CIs) were calculated using a weighted dataset. The aim of using the weighted dataset was to compensate for different probabilities in the sampling of subjects and differences in sex, age, and region compared to the population in Germany. Numbers (n) are provided without weighting. Detailed information on data handling and statistical methods is described previously.[13]

Results

Information on erosion was available for 924 younger adults; 43.2% of these had at least one tooth with erosion (Table 1). There was a noticeable difference in prevalence between men and women, at 49.1% vs 37.8%. The prevalence also varied amongst younger adults based on their education status. While 37.9% of individuals with a medium education status had erosions, the proportions amongst younger adults with a low education status (45.1%) and a high education status (49.2%) were distinctly higher. The same differences were found with regard to the maximum score of the erosions. Here, too, women and people with a medium education status had considerably fewer erosions than men and subjects with a low or high education status (Table 1). Despite these differences, no social gradient could be identified for the formation of erosions in younger adults in Germany.

The addition of the maximum BEWE scores of the single sextants (Fig 1) resulted in a stratification of the erosion findings and the derived erosion risks (Table 2). This stratification showed a medium risk level in 12.6% of participants (BEWE score 9 to 13) and a high risk level in 2.9% (BEWE score 14 to 18). Again, female participants and people with a medium education status had markedly lower risk profiles (Table 2).

Discussion

The survey found that 43.2% of 35- to 44-year-olds in Germany have at least one tooth displaying erosive wear. This means that almost every second adult in this age group is affected by erosion. Table 3 juxtaposes the current data with the findings of the DMS III (1997) and DMS V (2014) in order to compare the prevalences and assess the statistical development nationally over time.[8,9] It can be seen that the prevalence of erosions is

Table 1 Epidemiologic description of erosions (BEWE) in younger adults (35- to 44-year-olds) overall, and by gender and education groups

Variable		Total	Gender		Education group		
			Male	Female	Low	Medium	High
No. of participants (n)		924	458	465	78	407	383
Erosions (prevalence)		43.2% (40.1; 46.5)	49.1% (44.5; 53.7)	37.8% (33.6; 42.3)	45.1% (34.2; 55.3)	37.9% (33.2; 42.7)	49.2% (44.1; 54.1)
Maximum BEWE score (%)	No erosion	56.8 (53.6; 60.0)	50.9 (46.3; 55.5)	62.2 (57.7; 66.4)	54.9 (43.5; 64.6)	62.1 (57.3; 66.8)	50.8 (45.6; 55.7)
	Initial loss of surface structures	11.9 (10.0; 14.1)	11.3 (8.7; 14.5)	12.6 (9.8; 15.8)	7.7 (3.1; 14.3)	11.7 (8.7; 14.9)	13.1 (10.1; 16.9)
	Clinically manifest defect; loss of tissue < 50% of the most severely affected tooth surface	26.2 (23.4; 29.0)	29.3 (25.3; 33.7)	23.4 (19.7; 27.4)	29.3 (20.0; 39.3)	22.6 (18.7; 26.8)	29.7 (25.1; 34.3)
	Clinically manifest defect; loss of tissue ≥ 50% of the most severely affected tooth surface	5.1 (3.8; 6.7)	8.5 (6.1; 11.3)	1.9 (1.0; 3.5)	8.1 (3.9; 15.8)	3.6 (2.2; 6.0)	6.5 (4.4; 9.4)
Maximum BEWE score if erosion present (%)	No erosion	0.0 (NA)	0.0 (NA)	0.0 (NA)	0.0 (NA)	0.0 (NA)	0.0 (NA)
	Initial loss of surface structures	27.6 (23.4; 32.1)	23.1 (17.9; 29.0)	33.2 (26.5; 40.3)	17.2 (7.1; 30.4)	30.8 (23.5; 38.1)	26.6 (20.9; 33.6)
	Clinically manifest defect; loss of tissue < 50% of the most severely affected tooth surface	60.6 (55.5; 65.1)	59.6 (53.2; 66.0)	61.8 (54.5; 68.7)	65.0 (48.8; 78.7)	59.6 (51.7; 67.2)	60.2 (53.1; 67.0)
	Clinically manifest defect; loss of tissue ≥ 50% of the most severely affected tooth surface	11.8 (8.9; 15.2)	17.3 (12.7; 22.6)	5.0 (2.5; 9.0)	17.9 (8.9; 33.6)	9.6 (5.9; 15.5)	13.2 (9.1; 18.9)

Data are presented as unweighted numbers (n) and weighted percentages (with 95% confidence intervals) for dentate participants with valid information on erosion. One gender-diverse individual is included in the total column and the education groups, but not in the gender categories.
BEWE, basic erosive wear examination; NA, not available.

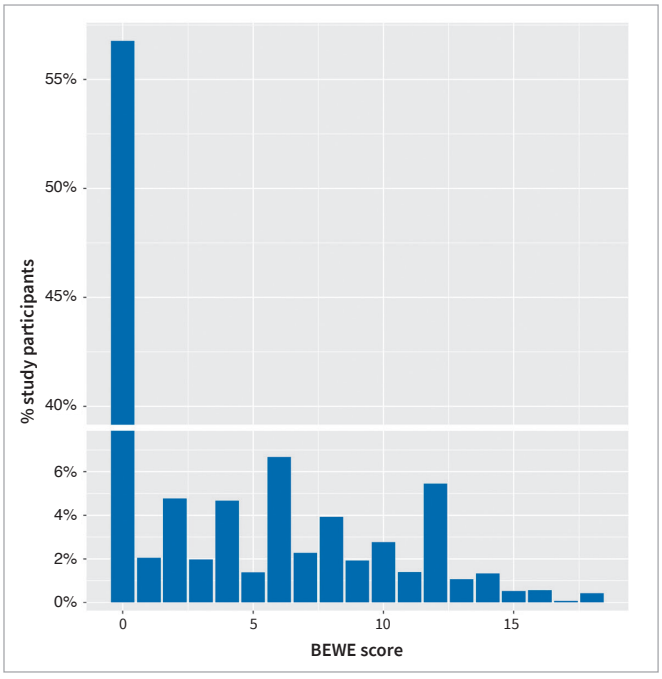

Fig 1 Distribution of the BEWE score sum of the maximum values for all sextants in younger adults (35- to 44-year-olds).

practically unchanged compared to the 2014 survey. Over a longer period, there was an increase in the prevalence of erosion compared to the 1997 survey; however, it should be noted that in the 1997 DMS III a different methodology was used, excluding occlusal erosions from the findings.

One figure that stands out is the much higher prevalence of erosions in men than in women. This finding conforms to the results of the previous national surveys.[8,9] However, the difference in prevalence of 11.3 percentage points in the current survey (49.1% in men, 37.8% in women) is around twice as high as in the previous surveys (1997: 5.9%[8]; 2014: 4.6%[9]). This higher prevalence of erosions in men compared to women is also found in the international literature,[7,14-16] sometimes to the same extent as identified in the present report.[17] Causes for the differences may be related to different eating behaviors,[16] reflux diseases,[16,17] or even the number of maintained teeth.[8]

The survey found different erosion prevalences according to education status, ranging from 37.9% in persons with a medium education status to 49.2% in study participants with a high education status. However, no linear correlation between higher

Table 2 Risk level classification of erosions (BEWE) in younger adults (35- to 44-year-olds) overall, and by gender and education groups

Variable		Total	Gender		Education group		
			Male	Female	Low	Medium	High
No. of participants (n)		924	458	465	78	407	383
Risk level classification (%)	No increased risk level	63.6 (60.4; 66.6)	56.5 (51.8; 61.0)	70.2 (66.0; 74.2)	57.2 (45.9; 66.9)	70.0 (65.3; 74.3)	58.1 (53.0; 62.9)
	Slightly increased risk level	20.9 (18.4; 23.6)	21.5 (17.9; 25.5)	20.4 (17.0; 24.2)	19.1 (11.9; 28.7)	18.7 (15.0; 22.6)	22.8 (18.7; 27.1)
	Medium risk level	12.6 (10.6; 14.8)	16.7 (13.4; 20.3)	8.7 (6.4; 11.5)	19.3 (11.9; 28.7)	9.9 (7.2; 13.0)	14.8 (11.5; 18.6)
	High risk level	2.9 (2.0; 4.2)	5.2 (3.5; 7.7)	0.7 (0.2; 1.7)	4.4 (1.6; 11.1)	1.4 (0.6; 3.1)	4.3 (2.5; 6.6)

Data are presented as unweighted numbers (n) and weighted percentages (with 95% confidence intervals) for dentate participants with valid information on erosion. One gender-diverse individual is included in the total column and the education groups, but not in the gender categories.
BEWE, basic erosive wear examination.

Table 3 Trends in prevalence, maximum score, and risk level classification of erosions (BEWE) in younger adults (35- to 44-year-olds) from DMS III, DMS V, and DMS • 6

Variable		DMS III* (1997)	DMS V (2014)	DMS • 6 (2023)
No. of participants (n)		655	961	924
Erosions (prevalence)		27.2%	44.8%	43.2%
Maximum BEWE score (%)	No erosion	72.8	55.2	56.8
	Low	6.4	15.5	11.9
	Medium	20.8†	27.4	26.2
	High		1.9	5.1
Risk classification (%)	No increased risk level	NA‡	70.4	63.6
	Slightly increased risk level		24.5	20.9
	Medium risk level		5.0	12.6
	High risk level		0.1	2.9

Data are presented as unweighted numbers (n) and weighted percentages for dentate participants with valid information on erosion.
*Without occlusal erosions.
†Classification different from BEWE.
‡The BEWE index used for the classification into risk levels was only developed in 2008.
BEWE, basic erosive wear examination; NA, not available.

education status and higher prevalence of erosion crystallized. A correlation between the prevalence of erosion and education group was found in a dataset of adults from seven European countries.[14] At the same time, a current review failed to identify a definite association with socioeconomic parameters.[16]

The comparison of the maximum erosion scores as well as the BEWE risk level classifications in the DMS V and the current data yields a significant finding (Table 3). The two surveys were carried out using the same methodology. While in the DMS V in 2014 a high maximum score was only found in 1.9% of participants,[9] the present figure is 5.1%. The shifts in the BEWE risk levels are even more striking. While in 2014, 5.0% of study participants were classified as having a medium risk level of erosion and only 0.1% as having a high risk level, in 2023, these figures were 12.6% and 2.9%, respectively. The proportion of younger adults in Germany with a medium or high prevalence of erosion has, therefore, tripled in 9 years. This finding is of clinical relevance with regard to the prevention and treatment of erosive wear.

Conclusion

The representative study found a high prevalence of erosive wear in younger adults in Germany. Almost every second per-

son in this group has at least one tooth affected by erosion. The prevalence is especially high amongst men. While the prevalence is practically unchanged compared to the 2014 survey using the same methodology, the proportions of younger adults with a high maximum degree of severity and with medium or high risk classification have tripled. These figures suggest that the prevention and treatment of erosive wear should receive more attention in dental medicine.

Disclosure

ARJ and KK are employed by the National Association of Statutory Health Insurance Dentists (KZBV). The authors declare that there are no conflicts of interest according to the Uniform Requirements for Manuscripts Submitted to Biomedical Journals. The interpretation of data and presentation of information is not influenced by any personal or financial relationship with any individual or organization.

Author contributions

All authors listed in the paper have contributed sufficiently to fulfill the criteria for authorship according to Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals (ICMJE Recommendations). All authors read and approved the final manuscript. US is a member of the scientific advisory board of the DMS • 6, responsible for developing the clinical examinations, and the author of the manuscript. ARJ is the principal investigator of the DMS • 6, responsible for developing the clinical examinations, and a co-author of the manuscript. HML is a member of the scientific advisory board of the DMS • 6, responsible for developing the clinical examinations, and a co-author of the manuscript. KK is the deputy principal investigator of the DMS • 6, responsible for the data analysis, and a co-author of the manuscript. KB is a member of the scientific advisory board of the DMS • 6, responsible for developing the clinical examinations, and a co-author of the manuscript.

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