

Bulimia and tooth erosion

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Eating disorders are often associated with regurgitation of gastric contents into the mouth and dental erosion. In this study the dental status was evaluated in bulimic patients. Thirty-five bulimics, diagnosed in the Outpatient Departments of Psychiatry and Adolescent Psychiatry of the University Central Hospital in Helsinki, and 105 controls matched for age, sex, and educational level were examined clinically, and the factors associated with dental erosion and caries were evaluated in an interview. Severe dental erosion and dental caries were significantly commoner among bulimics than controls. Bulimics commonly had a low salivary flow rate, but other apparent risk factors of dental erosion did not differ from those of controls. A feeling of dry mouth was commoner among bulimics than controls, and bulimics had an increased tooth sensitivity to cold and touch. More should be done to protect teeth from dental erosion among bulimics, because loss of tooth tissue remains even if the eating disorder disappears. □ *Dental caries; dental erosion; eating disorder*

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Bulimia is an eating disorder characterized by repeated episodes of binge eating and self-induced vomiting, episodes of strict dieting or fasting, and use of laxatives or diuretics. Bulimics are commonly overconcerned about body weight and shape, and self-accusation and depression may follow episodes of binge eating. The prevalence of bulimia is insufficiently known, but the disorder usually starts at the age of 17–25 years, and 90–95% of the patients are women (1, 2). According to one study from New Zealand, the life-long attack rate of bulimia within the 18- to 64-year-old general population is 1% (3). An increasing trend in bulimia incidence has been reported recently (4, 5).

Binge eating often involves food with high energy and sugar content. Consumption of sweet and acidic foods, and vomiting, may increase dental caries and loss of dental hard tissue by chemical processes that do not involve bacteria—that is, erosion (6–9). Episodes of binge eating and vomiting are often followed by vigorous dental cleaning practices, which may lead to further loss of hard tissue from dental surfaces (10). Eating disorders may also be associated with enlargement of salivary glands, with altered salivary chemistry (11).

Oral and dental changes in bulimics have been described in case reports (12–14) and in studies conducted without control groups (15, 16), but only a few properly designed studies have been published (17, 18). The common finding in these studies has been loss of dental hard tissue, but controversial results have been obtained with regard to other oral and dental changes (19, 20).

Dental erosion is a disorder that can be prevented. Here we report findings from a case-control study elucidating the effects of frequent vomiting in bulimia on dental

health. To this end we studied dental and salivary changes in bulimics, clarified their oral and dental hygiene practices, and asked about their knowledge of the orodental status.

Materials and methods

The case-control ratio was 1:3, which was fulfilled completely. Thirty-five female bulimics (mean age, 25.3 ± 6.8 years) and 105 controls (mean age, 25.7 ± 7.0 years) matched for age, sex, and education were investigated. The diagnosis of bulimia nervosa was based on the American Psychiatric Association's DSM III revised criteria (21). Diagnostic criteria for bulimia nervosa are 1) recurrent episodes of binge eating (rapid consumption of large amounts of food); 2) a feeling of lack of control of eating behavior during the binges; 3) regular engagement in self-induced vomiting, use of laxatives or diuretics, strict dieting or fasting, or vigorous exercise to prevent weight gain; 4) a minimum average of two binge eating episodes a week for at least 3 months; and 5) persistent overconcern about body shape and weight. The bulimics were supervised by the Outpatient Departments of Psychiatry and Adolescent Psychiatry of the University Central Hospital in Helsinki.

The controls were selected from the patients visiting the Students' Dental Health Service and the Institute of Dentistry, University of Helsinki, and from students at the Helsinki IVth College of Health Care Professionals and the Swedish Commercial College in Helsinki. All the bulimics were women, and their eating disorder had lasted for 5.5 ± 4.3 years. The Eating Attitude Test (EAT) (22)

Table 1. Distribution of persons with tooth wear by erosion, abrasion, and attrition among bulimics and matched controls

	Bulimics, n = 35		Controls, n = 105	
	n	%	n	%
Erosion**	22	63	12	11
Abrasion*	11	31	16	15
Attrition**	26	74	51	49

Significance of difference: ** P < 0.01, * P < 0.05.

and the Eating Disorder Inventory (EDI) (23) were used to confirm that the selected controls did not display symptoms of bulimic behavior.

In the clinical examination dental erosion was classified as one of three grades on buccal, lingual, and occlusal/incisal surfaces (24, 25). Abrasion and attrition were recorded separately (25). Bitewing radiographs were taken, and dental caries was recorded on the basis of WHO criteria: for carious surfaces, cavitation (DS) and pre-cavitation grades (DSini) were recorded (26, 27). Oral hygiene was evaluated in terms of the visible plaque index (VPI) and gingival bleeding index (GBI) (28). Periodontal treatment needs were recorded in accordance with the CPITN index (29). Color photographs and impressions for models were taken, and casts were made. The assessor did not know whether the subjects were bulimics or controls. To investigate intraexaminer reliability, 10 patients with dental erosion and caries were examined twice, 2 or more weeks apart. The kappa values for dental erosion and for caries recordings were from 0.74 to 0.94 (30).

Unstimulated and stimulated saliva samples were collected over 5-min periods. Buffering capacity was measured with the Dentobuff method (Dentobuff strip, Orion Diagnostica, Espoo, Finland). The numbers of salivary lactobacilli, *Streptococcus mutans*, and *Candida albicans* were assessed with Dentocult-LB, Dentocult-SM strip mutans, and Oricult-N kits, respectively (Orion Diagnostica).

Structured medical and dietary histories were taken. Emphasis was placed on past and present gastric complaints. Dietary habits were evaluated by means of questions relating to the consumption of acidic foods (31).

Table 2. Numbers of dental erosive lesions on buccal (B), lingual (L), and occlusal/incisal (O/I) surfaces among bulimics and controls

Tooth surface	Bulimics, n = 21: degree of erosion			Controls, n = 12: degree of erosion		
	I	II	III	I	II	III
B	148	17	0	21	0	0
L	133	20	4	13	0	0
O/I	81	102	9	8	29	0

Number of teeth

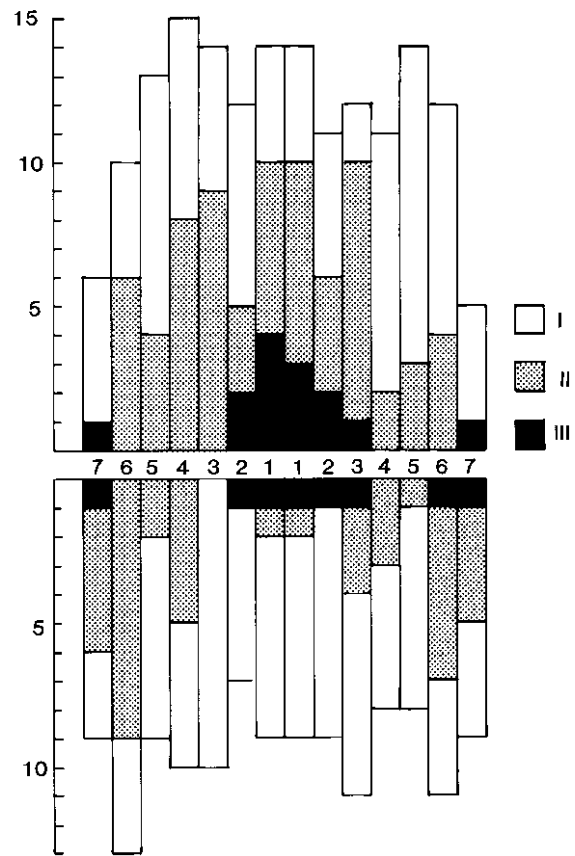


Fig. 1. Distribution of grades of erosion on teeth among bulimics (n = 21). Grade I: lesion involves superficial enamel only; grade II: lesion penetrates into the dentin less than a third of the tooth surface; and grade III: lesion penetrates into the dentin more than a third of the tooth surface.

Diseases and medicines that could have affected salivary flow rate were also recorded. Questions about tooth sensitivity to heat, cold, sweet, sour, food, and touch and the first observation of dental erosion were asked. Oral hygiene habits and use of topical fluorides were evaluated. Each interview and clinical examination lasted for about 1.5 h.

The statistical significance of differences between bulimics and controls were assessed in these matched data by the paired t test for continuous variables and the chi-squared test for dichotomous variables.

The Ethical Committee at the University Central Hospital approved the study.

Results

Tooth erosion, abrasion, and attrition were 1.5–6 times more frequent among bulimics than controls (Table 1). No

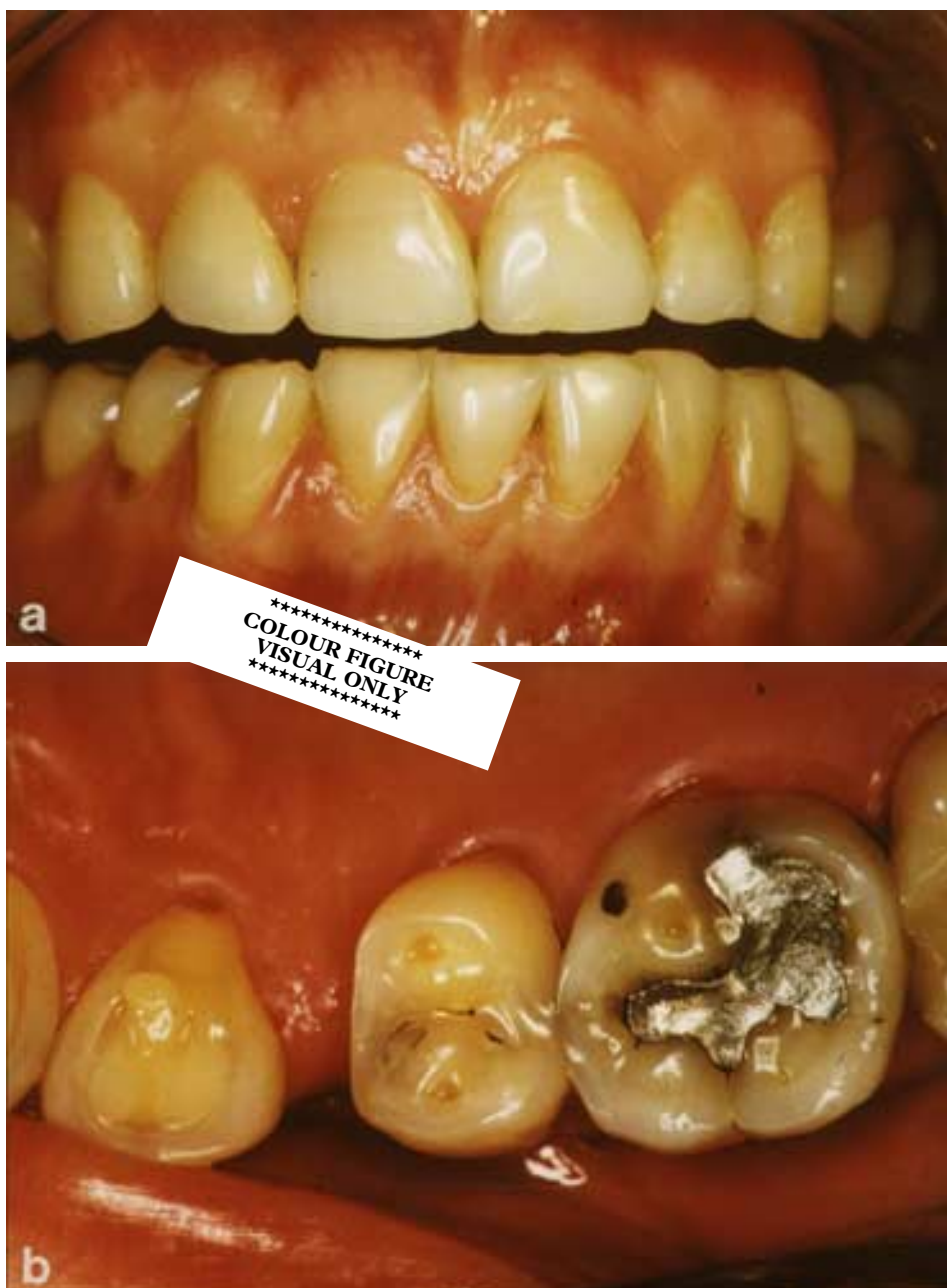


Fig. 2. A 27-year-old woman who has vomited one to six times daily for 6 years. She had 57 eroded tooth surfaces (43 grade I, 3 grade II, and 11 grade III). Stimulated salivary flow rate was 2.0 ml/min, and unstimulated flow rate 0.2 ml/min. She had 3 decayed tooth surfaces and 15 ini decayed surfaces. 2a. Anterior view. 2b. Right maxillary teeth.

significant difference was detected between bulimics and controls with regard to the consumption of sour fruits and drinks, but it appeared that bulimics more commonly consumed soft drinks, apple vinegar, and herb tea. Twenty-five of the 35 bulimics vomited daily, eight weekly, and two never. Twenty-two bulimics had dental erosion. First-, second-, and third-degree erosion was

present on the buccal, lingual, and occlusal/incisal surfaces of the bulimics. In one case the patient informed us that the eroded teeth had been covered by crowns, and therefore the erosion could not be graded. Twelve of the 105 controls had erosion, and in most cases it was of the first degree (Table 2). Erosion was seen in all teeth but most often on the upper incisors (Fig. 1). Fig. 2 shows tooth

Table 3. Caries indices (mean and standard deviation, *s*) among bulimics and controls

	Bulimics, <i>n</i> = 35		Controls, <i>n</i> = 105	
	Mean	<i>s</i>	Mean	<i>s</i>
No. of teeth	28.2	2.1	28.5	1.1
DMFS	23.6	25.9	20.8	16.0
DS	1.2	1.8	0.7	0.8
DSini**	5.8	4.6	3.5	2.0
DS + DSini prox*	4.7	4.4	2.8	1.6
DS + DSini b-1*	1.2	1.6	0.6	0.9

Significance of difference: ** $P < 0.01$, * $P < 0.05$.

erosion in a 27-year-old woman who had vomited one to six times daily for 7 years.

Bulimics had more approximal caries lesions (DS + DSini proximal) than controls, and they also had more buccal-lingual caries (DS + DSini bucc-ling) than controls (Table 3).

No difference between bulimics and controls was seen in oral hygiene habits and periodontal status. Neither group had diseases or used medicines influencing salivary flow rate. There was no difference in the mean salivary flow rate between bulimics and controls, but the number of subjects with low unstimulated salivary flow rate (< 0.2 ml/min) was three times higher among bulimics than controls (Table 4). The feeling of dry mouth was three times commoner among bulimics than controls, and bulimics also had an increased tooth sensitivity to cold and touch (Table 5).

More than half of the bulimics (12 of 22) had discovered tooth erosion by themselves; in about a quarter of the patients (5 of 22) the erosion was observed for the first time in the present study. Almost all of the first-degree erosion

Table 4. Stimulated and unstimulated salivary flow rates (mean and standard deviation, *s*) and distribution of persons with a low salivary flow rate, low buffer capacity, high bacterial count in saliva, and feeling of dry mouth, among bulimics and controls

	Bulimics, <i>n</i> = 35		Controls, <i>n</i> = 105	
	Mean	<i>s</i>	Mean	<i>s</i>
Stim. flow rate, ml/min	1.9	0.6	1.6	0.4
Unstim. flow rate, ml/min	0.3	0.2	0.4	0.1
	<i>n</i>	%	<i>n</i>	%
Unstim. flow rate, < 0.2 ml/min*	11	31	8	8
Buffer capacity, pH < 4	7	20	12	11
Lactob. count, $> 10^5$ CFU/ml	22	63	45	43
<i>Streptococcus mutans</i> , $> 10^6$ CFU/ml	13	37	26	25
<i>Candida</i> growth	15	43	57	54
Feeling of dry mouth***	12	34	11	10

Significance of difference: *** $P < 0.001$, * $P < 0.05$.

Table 5. Sensitivity of teeth among bulimics and controls

Exposure	Bulimics, <i>n</i> = 35		Controls, <i>n</i> = 105	
	<i>n</i>	%	<i>n</i>	%
Heat	5	14	5	5
Cold***	19	54	19	18
Sweet	7	20	8	8
Sour	3	9	2	2
Food	2	6	1	1
Touch***	15	43	8	8

Significance of difference: *** $P < 0.001$.

lesions seen among the controls (10 of 12) were detected at the examination in the present study.

Discussion

Loss of dental hard tissue in erosion, abrasion, and attrition is a common and uncomfortable consequence of bulimia. The patient may be cured of the basic disease, but the loss of dental hard tissue remains. Severe erosion is difficult to treat adequately, and the treatment is expensive. It is obvious that the main factor leading to erosion among bulimics is repeated vomiting. Gastric contents, with a pH close to 1, affect tooth surfaces severely. According to an earlier study (31), the adjusted odds ratio for erosion was 31 for individuals who vomited daily, as compared with non-vomiting individuals. The vomiting individuals did not all have erosion; among bulimics the factors that are associated with the occurrence and severity of erosion are the duration of the disease, the frequency of vomiting, and the amount of saliva. Saliva will neutralize acidic gastric contents and shorten the duration of harmful exposure. As shown, in subjects with low salivary secretion acidity remains high, especially on the surface of the tongue, and therefore tooth erosion is most marked on the palatal surfaces of the incisors touched by the tongue (25) (Fig. 2b). In addition to a direct dissolution of the enamel, the material softened by acids is also susceptible to mechanical wear. Consequently, signs of wear caused by chewing and toothbrushing were readily detected in bulimics. Vigorous toothbrushing and other methods of oral cleaning are common among bulimics during the periods that follow binge eating and vomiting.

In this study the high prevalence of tooth damage among bulimics, as compared with controls, was not associated with different drinking and eating habits (except binge eating), oral hygiene practices, or use of medicines affecting salivary flow. It may be noted, however, that about one-third of the bulimics had a low unstimulated salivary flow rate and hence decreased protection against tooth erosion.

Provided that the bulimics know the deleterious effects of vomiting, they can reduce the tooth damage by

neutralizing the gastric contents with water and antacids immediately after vomiting. This should not be too difficult in practice because the bulimics regularly plan the binge eating and self-induced vomiting in advance. Thus, use of antacids might reduce the risk of especially disfiguring irreversible tooth changes. These cosmetic changes are conspicuous and harmful even after the basic disorder has been cured.

The bulimics are infrequently aware of the tooth complications associated with their disease, and they do not recognize the damage until the loss of dental hard tissue is extensive or the teeth have become highly sensitive to external stimuli. Half of the bulimics examined in this study had not noticed the tooth erosion by themselves until the damage had reached an advanced stage. Furthermore, even relatively advanced damage may go unnoticed. In three of the five patients with erosion detected in this study for the first time, the damage was already of the second degree.

It seems that to prevent extensive tooth damage among bulimics and to retain reasonable chances for a successful treatment, it is important that the physician seeing a bulimic patient contacts a dentist at an early stage. On the other hand, the dentist is often the first person to see tooth erosion in a patient. He/she should then consider carefully the cause of erosion—that is, whether it is associated with dietary factors or exposure to gastric contents, especially vomiting. If vomiting turns out to be an apparent possibility, and an eating disorder is suspected, the dentist should send the patient to psychiatric consultation for confirmation of the bulimia diagnosis and subsequent treatment.

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