

## The distribution of erosion in the dentitions of patients with eating disorders

N. D. Robb,<sup>1</sup> BDS, PhD, FDSRCSEd, B. G. N. Smith,<sup>2</sup> BDS, PhD, MSc, FDSRCSEng, and E. Geidrys-Leeper,<sup>3</sup> BDS, MScD, FDSRCSEng

<sup>1</sup>Department of Restorative Dentistry, The Dental School, Framlington Place, Newcastle upon Tyne, NE2 4BW; <sup>2</sup>Department of Conservative Dental Surgery, Floor 25, Guy's Tower, London Bridge, London, SE1 9RT; <sup>3</sup>St George's Hospital, Blackshaw Road, London, SW17 0QT

Anorexia and bulimia nervosa (the eating disorders) are potentially life threatening and are becoming more prevalent. This paper reviews the effects of these disorders on dental erosion and reports a study to assess the effects of the eating disorders on the erosion of teeth relating the severity of erosion to factors such as the frequency of self-induced vomiting (SIV). One hundred and twenty-two eating disorder patients and an equal number of age, sex, and social class matched controls were studied. The study population was divided into subgroups according to the eating disorder. All the subgroups had significantly more abnormal toothwear than the controls ( $P < 0.005$ ), with the differences being most marked in the SIV groups. Further analysis did not find any consistent relationships to the frequency or duration of SIV.

Anorexia and bulimia nervosa are two related disorders which affect the regulation of food intake in sufferers. The conditions are increasingly embraced by the term 'the eating disorders' in the psychiatric literature. The eating disorders can be classified as shown in figure 1. The diagnostic criteria for each group used in this study were:

1. Abstaining anorexia nervosa (AAN). Those with clinically diagnosed anorexia nervosa, who were or had been more than 10% below ideal body weight, but who did not binge eat or vomit. A short episode of vomiting was permitted, provided that it was less than one month in duration.

2. Vomiting anorexia nervosa (VAN). Those with clinically diagnosed anorexia nervosa, who were or had been more than 10% below ideal body weight, and who did binge eat or vomit on a regular basis.

3. Uni-impulsive bulimia nervosa (BN). Those who regularly binge ate and vomited, but whose body weight was within 10% of ideal body weight. There was to be no history of abuse of alcohol, controlled drugs, or of abnormal sexual practices.

4. Multi-impulsive bulimia nervosa. Those who regularly binge ate and vomited, but whose body weight was within 10% of ideal body weight.

There was a history of abuse of alcohol, controlled drugs, or of abnormal sexual practices.

The eating disorders have been extensively studied, and approximately 100 papers per month were being published during the 1970s.<sup>1</sup>

### Toothwear (erosion)

There have been numerous papers published quoting cases of bulimic or vomiting anorectic patients with the 'classical' lingual erosion of the maxillary anterior teeth.<sup>2-5</sup> This condition has been named perymolysis,<sup>6</sup> but this term is not commonly used now. These papers describe essentially the same picture. The classical pattern of erosion seen in these cases is shown in figure 2. The diagnostic criteria for this type of erosion are typically:

- extensive erosion of the palatal aspects of the upper anterior teeth
- moderate erosion of the buccal surfaces of the upper anterior teeth
- the lingual surfaces of the lower anterior and posterior teeth are virtually unaffected
- erosion of the palatal aspects of the upper posterior teeth
- variable erosion of the occlusal and buccal surfaces of upper and lower posterior teeth

This paper looks at the erosive effects of eating disorders and finds that even non-vomiting patients with anorexia nervosa demonstrate more tooth wear than controls

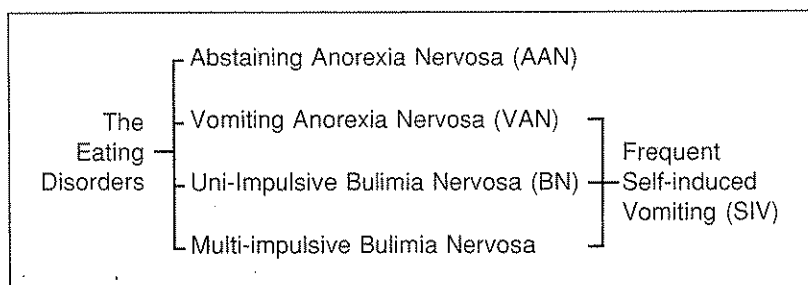


Fig. 1 Classification of the eating disorders (only AAN, VAN and BN were included in this study).



Fig. 2 Erosion produced by the chronic self-induced vomiting of bulimia nervosa.

- restorations standing proud of the eroded surfaces
- absence of staining on eroded surfaces.

Reviews in the dental literature of the occurrence of this condition are given by a number of authors.<sup>7-9</sup> There are five papers which report series of patients.<sup>10-14</sup> These reports result from samples ranging between 17 and 66 patients. Hellstrom<sup>11</sup> divided the patients into those who vomited and those who did not. The main differences between the two groups were that severe lingual and moderate buccal erosion was apparent in virtually all the vomiting patients, but rare in the non-vomiting. Attempts were made to correlate this with the saliva flow rate. Most of the patients showed some disturbance in flow rates, with very low rates in the vomiting groups. Hurst *et al.*<sup>12</sup> also split their sample into those who had either vomited or regurgitated regularly in the last 3 years and those who had not. There did not appear to be significant differences in diet between the two groups and the results were consistent with Hellstrom's<sup>11</sup> findings. Roberts and Li<sup>10</sup> reported that only 35% of 17 anorectic and 33% of 30 bulimic patients showed erosion. The authors commented that this result was surprisingly low as all the bulimics 'practised' psychogenic vomiting. Simmons *et al.*<sup>13</sup> found that 38% of their patients had clinically observable erosion.

Milosevic and Slade<sup>14</sup> showed that patients with anorexia or bulimia nervosa had higher levels of erosion than controls. It is, however, unclear from the paper whether the patients suffering

from anorexia nervosa were using self-induced vomiting (SIV) as a control of dietary intake.

There has been little attempt to explain why some patients who use SIV as a means of weight control have erosion and some do not, nor to relate these differences to factors such as frequency of vomiting. There has been only one published study<sup>14</sup> using unaffected individuals as controls in the literature.

#### *Aim of the present study*

The aim of the present study was to assess the differences in prevalence of dental erosion in patients suffering from eating disorders, and a control population. History of the eating disorder was compared with the prevalence of erosion.

## Subjects and methods

Patients who had already been diagnosed as suffering from one of the eating disorders and who were receiving treatment were seen at the psychiatric institutions listed below:

- Central Middlesex Hospital, London
- One private psychiatric practice, London
- Royal Edinburgh Hospital, Edinburgh
- Royal Free Hospital, London
- Maudsley Hospital, London
- Gordon Hospital, London
- The Hospital for Sick Children, Great Ormond Street, London
- St George's Hospital, London
- Atkinson Morley, London.

Criteria for inclusion in the study were a willingness to participate, and a minimum of 12 scoreable permanent teeth. All patients were initially approached by the therapist in charge of their care and they all agreed to participate. One patient was excluded as she had previously had an upper arch reconstruction.

The patients were assigned to one of three groups according to the psychiatric diagnosis:

1. Abstaining anorexia nervosa (AAN)
2. Vomiting anorexia nervosa (VAN)
3. Uni-impulsive bulimia nervosa (BN).

In patients with BN a previous history of anorexia was recorded as present or absent. The patients were all seen by the same examiner (NDR), and had detailed histories taken of the factors known to be involved in the aetiology of toothwear and the eating disorders taken under the headings: factors involved in the toothwear history (diet, digestive disorders, oral hygiene practices, habits — eg bruxism and nail biting, present medical and dental history, past medical and dental history) and factors involved in the eating disorder history (duration of eating disorder, duration of amenorrhea, lowest body weight during illness, frequency of SIV, duration of SIV, oral hygiene post SIV).

A 'tooth wear index'<sup>15</sup> was recorded scoring cervical, buccal, occlusal, and lingual surfaces of all standing permanent teeth, giving a maximum of 128 surfaces per dentition. Missing, restored and unscorable surfaces were also recorded, as was Angle's classification, quality of posterior support, and ease of movement in lateral and protrusive excursions.

The raw data were analysed using a specially written computer programme to produce profiles of unacceptable levels of wear for each age group for different groups of sites.<sup>16</sup>

A control group of subjects with no history of the eating disorders was used for comparison. The control group was selected from a separate study of 1007 dental attenders from 102 practices in the South East of England.<sup>17</sup> The patients from this study had similar histories and examinations carried out by the same examiner (NDR) and the data were handled in the same way.

The control for each eating disorder patient was selected by the computer programme to obtain the best match for age, sex, social class according to occupation, and number of standing teeth. Any subjects from the control group whose history indicated a possibility of an eating disorder was excluded prior to the matching process. All the patients in the control group had a computer generated random number assigned to them, and if multiple matches were found the lowest random number selected. This method was used in a previously published study of subjects suffering from chronic alcoholism.<sup>18</sup>

The mean per cent of tooth surfaces with unacceptable levels of wear was calculated for each of the experimental groups and their controls. The tooth sites were grouped as follows:

- Upper posterior cervical
- Upper posterior buccal
- Upper posterior occlusal
- Upper posterior lingual
- Upper anterior cervical
- Upper anterior buccal
- Upper anterior incisal
- Upper anterior lingual
- Lower posterior cervical
- Lower posterior buccal
- Lower posterior occlusal
- Lower posterior lingual
- Lower anterior cervical
- Lower anterior buccal
- Lower anterior incisal
- Lower anterior lingual.

The differences between mean wear scores for each group of sites for the control and experimental groups were compared using the Student's *t*-test. Further analysis of the effects, frequency and duration of vomiting, and post-vomiting oral hygiene practices was carried out using analysis of variance.

## Results

### *The tooth prevalence of unacceptable toothwear (erosion)*

Table I shows the differences between the experimental and control groups. All of the experimental groups had significantly more toothwear than the control groups ( $P < 0.005$ ). The standard deviations in these groups are large — indicative of the wide variation within the groups.

### *The distribution of unacceptable toothwear (erosion)*

The distribution of unacceptable toothwear is shown in figures 3–5. The figures are presented in a similar manner to the results of the study of dental attenders,<sup>17</sup> the previous report of our study on chronic alcoholics,<sup>18</sup> and the original description of the wear patterns for a number of different aetiologies,<sup>16</sup> so that comparisons between the studies can be made. Figure 2 shows the mean unacceptable toothwear for the tooth site groups for the AAN and control groups. The AAN group has significantly more wear on the buccal and occlusal surfaces of the lower posterior teeth ( $P < 0.05$ ). The cervical surfaces are recorded as being significantly less worn in the AAN group, but this is likely to be because with this type of erosion there is no difference between buccal and cervical wear, as was often found in the control group.

Figures 4 and 5 show the wear for the VAN and BN groups and their controls respectively. In both cases there is significantly more wear on several surfaces of upper and lower teeth. The pattern for the vomiting groups is typical of regurgitation erosion.<sup>16</sup>

### *Analysis of other factors*

Analysis of the frequency of vomiting and duration of vomiting, and post-vomiting oral hygiene practices of the patients within the VAN and BN groups did not show any significant differences in levels of erosion between those who vomited frequently and those who vomited less frequently. There was also no difference between those who routinely brushed their teeth immediately post-vomiting, and those who did not.

**Table I** Number of sites affected by toothwear

Group	<i>n</i>	% of tooth sites with unacceptable levels of toothwear	SD	<i>P</i>
AAN	54	7.42	6.83	0.0023
Control	54	3.52	6.12	
VAN	29	17.92	11.88	0.0001
Control	29	4.47	6.89	
BN	39	18.32	12.59	0.0001
Control	39	4.65	5.89	

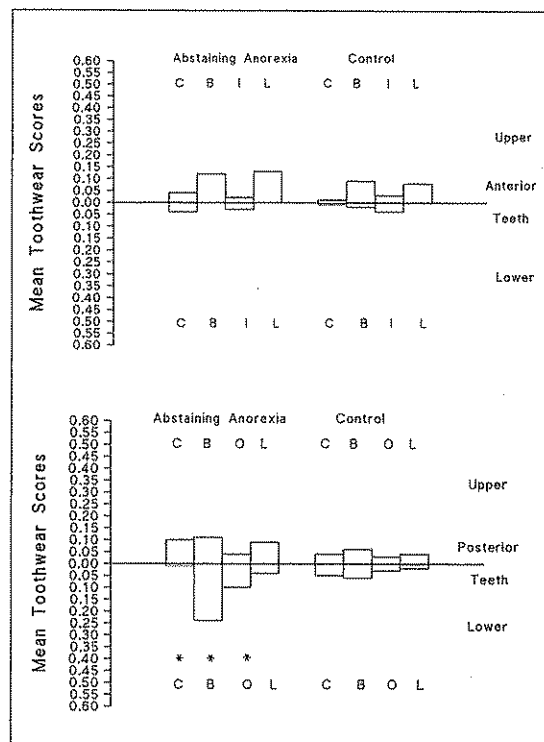


Fig. 3 Mean unacceptable toothwear scores for abstaining anorexia (AAN) and control groups ( $n = 54$ ). The top figure shows the anterior teeth, and the lower the posterior. Bars above the line represent the upper teeth and those below the lower teeth. The tooth surfaces are indicated by the abbreviations C for cervical, B for buccal, O/I for occlusal/incisal, L for lingual. Significant differences ( $P < 0.05$ ) between patients and controls are shown by an asterisk.

## Discussion

There have been many publications reporting an increased level of erosion in those who vomit as a result of these conditions. This study also shows that those who suffered from anorexia nervosa but did not vomit also have more erosion than a control population, although less than the vomiting groups. This finding raises doubts over results reported in previous studies where abstaining anorectic patients have been used as controls for vomiting groups.<sup>11,12</sup> The observation that abstaining anorectic (AAN) subjects have significantly more toothwear on the lower posterior buccal and occlusal tooth surfaces is interesting, but difficult to explain.

The erosion in the vomiting groups was often clinically catastrophic, both in the extent and the probable rate of progress. It was not uncommon to find teenage girls with complete loss of the palatal enamel of the upper anterior teeth. This produces a poor and declining appearance and a very difficult restorative problem. In relatively immature girls with an obsession about appearance this could be a factor in perpetuating the psychological problems. Relatively short term solutions, such as the provision of palatal veneers, while the under-

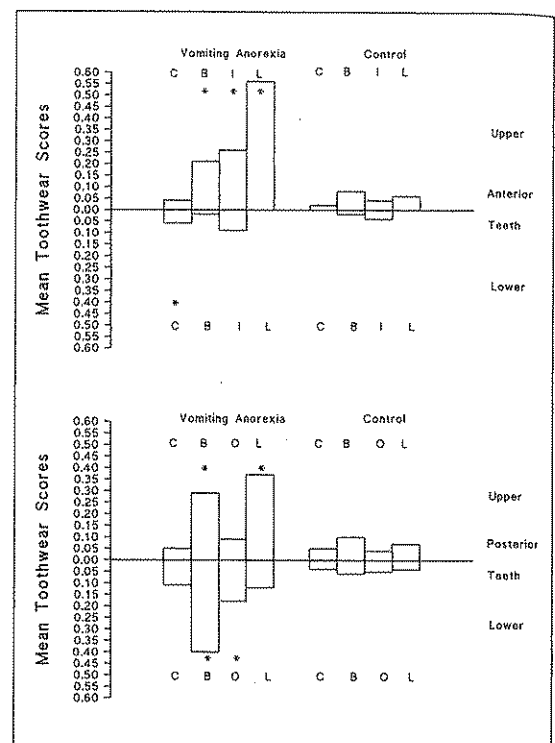


Fig. 4 Mean unacceptable toothwear scores for vomiting anorexia (VAN) and control groups ( $n = 29$ ). The top figure shows the anterior teeth, and the lower the posterior. Bars above the line represent the upper teeth and those below the lower teeth. The tooth surfaces are indicated by the abbreviations C for cervical, B for buccal, O/I for occlusal/incisal, L for lingual. Significant differences ( $P < 0.05$ ) between patients and controls are shown by an asterisk.

lying condition continues, may do more physical harm than psychological good, as the repairs deteriorate. This deterioration may expose rough surfaces that will produce rapid wear of the opposing teeth. If the treatment can be timed appropriately, full crowns can significantly improve the appearance and give a therapeutic psychological boost.

When the intragroup variation was considered, the lack of relationship between the variables of vomiting frequency, duration of vomiting and post-vomiting oral hygiene practices and erosion is interesting. A possible explanation is different susceptibilities to erosion in different subjects. It is a common clinical observation that patients with broadly similar eating disorder histories, and indeed non eating disorder patients with similar diets which would be expected to be erosive, have markedly different rates of toothwear. It is possible that factors such as salivary buffering capacity, flow rate and pH or tooth surface composition may be at least as important as the frequency of acid attack.

There is a significant mortality and morbidity associated with the eating disorders. In teenagers this often leads to prolonged absences from school at a time when important examinations are pend-

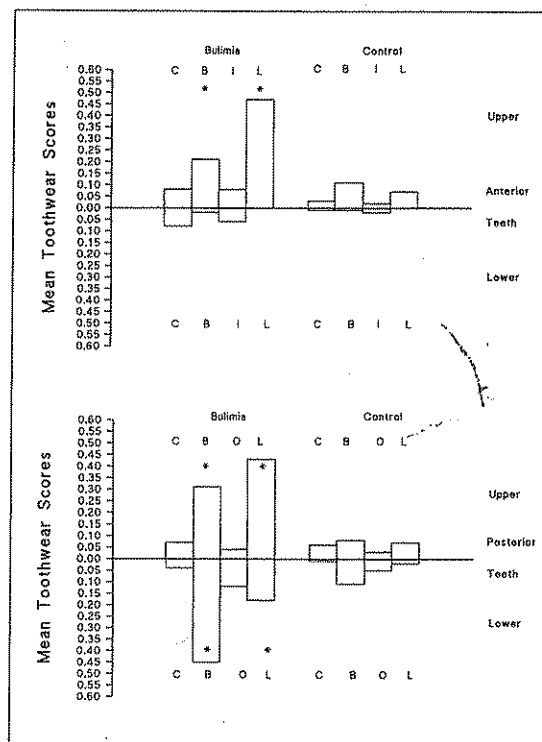


Fig. 5 Mean unacceptable toothwear scores for bulimia (BN) and control groups ( $n = 39$ ). The top figure shows the anterior teeth, and the lower the posterior. Bars above the line represent the upper teeth and those below the lower teeth. The tooth surfaces are indicated by the abbreviations C for cervical, B for buccal, O/I for occlusal/incisal, L for lingual. Significant differences ( $P < 0.05$ ) between patients and controls are shown by an asterisk.

ing. It seems that the presenting age of patients with anorexia or bulimia nervosa at dental clinics is lower than at psychiatric clinics. It is therefore possible that patients seen by dentists for toothwear problems may take some years to be diagnosed medically. The GDP may be in an ideal position to raise the possibility of an underlying psychiatric disorder from changes in the dentition.

Another notable finding from several of the subjects in this study was that they had stopped being regular dental attenders having read some of the articles in women's magazines about the dental effects of the eating disorders. This response was prompted by fear of their dentist diagnosing the eating disorder from the dental signs. In one of these cases the dentist was the patient's mother, and in another a close family friend.

## Conclusions

Patients suffering from anorexia and bulimia nervosa have a significantly higher level of erosion than a control population. An increased level of unacceptable toothwear is found in abstaining anorexia nervosa, but it is much less marked than in those who use self-induced vomiting as a method of controlling dietary intake. The level of erosion

cannot be directly related to variables such as frequency or duration of vomiting in this study. The GDP may be in an ideal position to spot the early signs of the eating disorders in his or her patients.

## Acknowledgements

The authors would like to thank all the clinicians who allowed their patients to be interviewed as part of this study, and the patients who were willing to give of their time. This study was supported by grants from the Special trustees of Guy's Hospital, and the Endowment Fund of St George's Hospital, London.

## References

- 1 Russell G F M. The present status of anorexia nervosa. *Psychol Med* 1977; 7: 353-367.
- 2 Miles D A, Gregg B E, Glass B J, van Dis M L. Bulimic erosion. Dental management and report of a case. *J Can Dent Assoc* 1985; 51: 757-760.
- 3 Brady W F. The anorexia nervosa syndrome. *Oral Surg* 1980; 50: 509-516.
- 4 Stege P, Visco Dangler L, Rye L. Anorexia nervosa: review including oral and dental manifestations. *J Am Dent Assoc* 1982; 104: 648-652.
- 5 Andrews F F H. Dental erosion due to anorexia nervosa with bulimia. *Br Dent J* 1982; 152: 89-90.
- 6 Holst J J, Lange F. Perimolysis: a contribution towards the genesis of tooth wasting from non-mechanical cause. *Acta Odontol Scand* 1939; 1: 36-48.
- 7 Clark D D. Oral complications of anorexia nervosa and/or bulimia: with a review of the literature. *J Oral Med* 1985; 40: 134-138.
- 8 Gross K, Brough K M, Randolph P M. Eating disorders: anorexia and bulimia nervosa. *J Dent Child* 1986; 53: 378-381.
- 9 Knewitz J L, Drisko C L. Anorexia and bulimia: a review. *Compend Continuing Educ Dent* 1988; 244: 244-247.
- 10 Roberts M W, Li S-H. Oral findings in anorexia and bulimia nervosa: a study of 47 cases. *J Am Dent Assoc* 1987; 115: 407-410.
- 11 Hellstrom I. Oral complications in anorexia nervosa. *Scand J Dent Res* 1977; 85: 71-86.
- 12 Hurst P S, Lacey J H, Crisp A H. Teeth, vomiting and diet: a study of the dental characteristics of seventeen anorexia nervosa patients. *Postgrad Med J* 1977; 53: 298-305.
- 13 Simmons M S, Graydon S K, Mitchell J E. The need for psychiatric-dental liaison in the treatment of bulimia. *Am J Psychiatry* 1986; 143: 783-784.
- 14 Milosevic A, Slade P. The orodental status of anorexics and bulimics. *Br Dent J* 1989; 167: 66-70.
- 15 Smith B G N, Knight J K. An index for measuring the wear of teeth. *Br Dent J* 1984; 156: 435-438.
- 16 Smith B G N, Knight J K. A comparison of patterns of tooth wear with aetiological factors. *Br Dent J* 1984; 157: 16-19.
- 17 Robb N D. Epidemiological studies of tooth wear. PhD Thesis, University of London, 1992.
- 18 Robb N D, Smith B G N. Prevalence of pathological tooth wear in patients with chronic alcoholism. *Br Dent J* 1990; 169: 367-369.