

Depth and Area of Dental Erosions, and Dental Caries, in Bulimic Women

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Dental caries and the severity (depth) and area of erosions of tooth substance were studied in 11 bulimic subjects and 22 matched controls. Erosions were seen in 69% of the bulimics' teeth and in only 7% of the controls' ($p < 0.001$). Depth of penetration was greater in the bulimics, extending even into the pulp, and the area of erosion was also larger. Scores for dental caries were higher in bulimics (mean DMFS 27.9, median 36) than in controls (mean DMFS 19.1, median 13.5), although the difference was not statistically significant. This study suggests that when erosions are present on the lingual surfaces of maxillary anterior teeth, as well as on the buccal surfaces of maxillary canines, premolars, and maxillary incisors, a diagnosis of bulimia is likely. Patients with these signs should be referred for medical help.

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Introduction.

Bulimia is a subgroup of chronic anorexia nervosa in which there is habitual overeating and vomiting (Garfinkel and Garner, 1982). Typically, the condition is seen in females (Stege *et al.*, 1982). There is a reduced salivary flow (Toone and Lader, 1979) as well as a high consumption of fruits or fruit juices to quench thirst after vomiting (Schaaf, 1984).

Dental features reported among bulimics are erosion of tooth enamel and a high prevalence of caries and sensitive teeth (Holst and Lange, 1939; Hellström, 1974; Hurst *et al.*, 1977; Stege *et al.*, 1982; Clark, 1985). These features have been outlined in clinical case reports; however, quantification of erosions and dental caries in bulimics and matched controls has not been reported. The objective of this investigation was to quantify erosions and dental caries in bulimics and matched controls.

Materials and methods.

Prior to our undertaking the study, the protocol was approved by the Committee for Research on Human Subjects of the University of the Witwatersrand, Johannesburg, and informed consent was given by all the participants. Eleven diagnosed bulimic white females attending a private dental office were each matched to two control non-bulimic females in the same office, according to age, gender, language, educational level, residential area, and social class; the latter was determined by their occupation (Schlemmer and Stopforth, 1979; Office of Population Censuses and Surveys, 1970). Selection was not based on their dental condition. All were exposed to the same fluoride level (0.21-0.33 ppm) in drinking water (Dreyer and Grobler, 1984). The ages in the bulimic group (mean, 29.8; SD, 8.4 years) and control group (mean, 28.9; SD, 9.0 years) were not significantly different. Most subjects were in their thirties.

Erosions were defined as "dished out" areas of enamel, or

enamel and dentin, on the buccal or lingual tooth surface. They were graded by depth (absent, into enamel only, into enamel and dentin, into pulp) and by area ($< 1/3$; $1/3-2/3$; $> 2/3$ of the tooth surface).

Using plane mirrors and sharp curved probes, we examined the teeth of the subjects under tungsten light in the dental office; recent bite-wing radiographs in practice records were also studied. World Health Organization (1977) caries-diagnostic criteria were used, and radiolucent areas in enamel or dentin on bite-wing radiographs were recorded as caries. The FDI tooth numbering system was used. For dental caries, the single examiner (RRHJ) was calibrated prior to the study (Cleaton-Jones *et al.*, 1989), and his Modified Percentage Reproducibility (Shaw and Murray, 1975) was 93.7%.

The information recorded was analyzed in an IBM 3083 J24 computer by means of the Statistical Analysis System (1985). Tests used were the Chi-square (for prevalences of erosions and caries), the median test (for DMFT scores), and Student's *t* test for independent samples (for age comparisons). The critical level of statistical significance chosen was $p < 0.05$.

Results.

Erosions: Severity.—The percentage prevalence of teeth with any grade of erosion on the buccal and/or lingual surfaces was 7% in the control group and 69% in the bulimic group, indicating significantly higher susceptibility in the bulimic group ($\chi^2 = 7.01$, $p < 0.001$). The numbers of teeth studied are listed in Table 1, and the percentage prevalences of teeth with the three grades of erosion severity are listed in Table 2 by tooth type, by group, and by buccal and lingual surfaces. A higher frequency of erosions was found in the bulimic patients. On the buccal surfaces, the bulimics' erosions were mainly in the premolar and canine teeth, in the maxilla, and in the premolar and molar mandibular teeth. On the palatal/lingual surfaces, erosions affected particularly the incisor and canine teeth in both jaws.

In the control group, only erosions in enamel were seen, compared with erosions to all depths in the bulimic group. Erosions into the pulp were seen on maxillary teeth 12 and 24, and on mandibular teeth 42, 41, and 31 among bulimics. The areas of erosion are listed in Table 3, and from this, it can be seen that most erosions affected less than one-third of the tooth surface.

Dental caries.—Only one subject in the control group and two in the bulimic group were caries-free. The mean DMFS scores for the control and bulimic groups were 19.1 (SD, 15.9; median, 13.5) and 27.9 (SD, 22.6; median, 36), respectively, but the difference was not statistically significant.

TABLE 1
NUMBERS OF TEETH STUDIED

		I1	I2	C	PM1	PM2	M1	M2
Maxilla	Controls	42	41	43	39	43	39	42
	Bulimics	16	16	18	16	16	16	16
Mandible	Controls	44	44	44	43	44	41	40
	Bulimics	20	19	19	18	17	17	17

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TABLE 2

PERCENTAGE OF EACH TOOTH TYPE WITH EROSIONS BY EROSION DEPTH (1 = IN ENAMEL ONLY, 2 = IN ENAMEL AND DENTIN, 3 = INTO PULP; MISSING VALUES INDICATE NO EROSIONS)

Tooth	Maxilla						Mandible					
	Controls			Bulimics			Controls			Bulimics		
	1	2	3	1	2	3	1	2	3	1	2	3
Buccal	I1	7			5	5					9	9
	I2	7			5		2			5	9	5
	C	7			27	27	9			9	9	5
	PM1	16			32	14	14			27	14	
	PM2	7			5	18	5	9		18	14	5
	M1				5	9				18	18	
	M2				9	9				14	14	
Palatal/lingual	I1	14			14	41					27	14
	I2	5			5	32	5			9	18	14
	C				5	55					14	
	PM1				18	14	5			9	9	
	PM2				5	14				5	5	
	M1				5	9					9	
	M2				9	9					9	

Interrelationship between erosions and dental caries. — We plotted as bar charts the percentage prevalences of each lesion for each tooth type for buccal and palatal/lingual surfaces in the bulimic and control groups (Figs. 1-4). The higher prevalences of both erosions and caries on the buccal surfaces of maxillary and mandibular teeth of bulimics are clearly demonstrated (Figs. 1,2).

In the maxilla, buccal caries was most common in the second premolar, and erosions were more frequent than caries in the canine and first premolar teeth. In the mandible, the tooth with the most caries was the first molar, and both premolars

had more erosions than caries. For the remaining teeth, erosion prevalence was approximately three-quarters that of caries prevalence. In the control group, erosions were less prevalent than caries for all tooth types, and the prevalence of caries on the buccal surfaces of the molars and second premolars was less than for the more anterior teeth in the maxilla. In the mandible, erosion was more frequent than caries in the canines, but caries prevalence was similar in the premolars and molars.

The levels of caries and erosion prevalence on the palatal/lingual surfaces are shown in Figs. 3 and 4. In the maxillary teeth, few erosions were seen and, when present, were only on the central and lateral incisor, and caries on the buccal surface was most common in the first molar teeth. Dental caries was similar in prevalence in the remaining tooth types.

TABLE 3

PERCENTAGE EROSION AREA BY GROUP (1 = < 1/3 SURFACE, 2 = 1/3-2/3 SURFACE, 3 = > 2/3 SURFACE)

		Maxilla			Mandible		
		1	2	3	1	2	3
Buccal	Controls	7	1	0	4	0	0
	Bulimics	22	9	1	23	9	2
Palatal	Controls	2	<1	0	0	0	0
	Bulimics	26	15	6	12	8	2

Discussion.

There were several difficulties associated with this study. First, there was the problem of diagnosis of bulimia. This is very difficult even for trained medical personnel because of the secretive nature of the patients. For this reason, only patients who had already been diagnosed as bulimic by a psychiatrist were included in the investigation. Even when the diagnosis had been made, it was extremely difficult to recruit

MAXILLARY TEETH - BUCCAL SURFACE

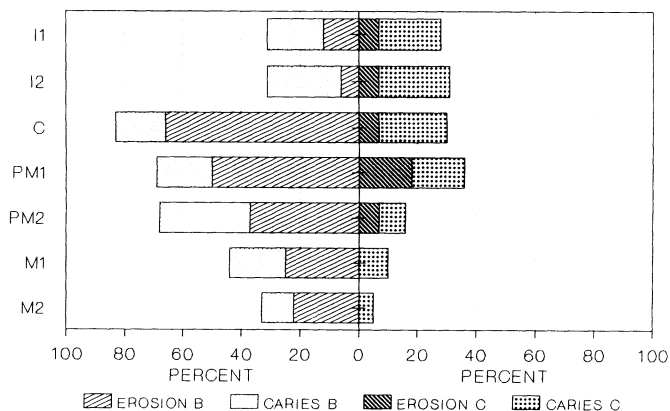


Fig. 1 — Bar chart of percentage of each tooth type with dental caries and/or erosions on the buccal surfaces of maxillary teeth by group (B = bulimic group, C = control group).

MANDIBULAR TEETH - BUCCAL SURFACE

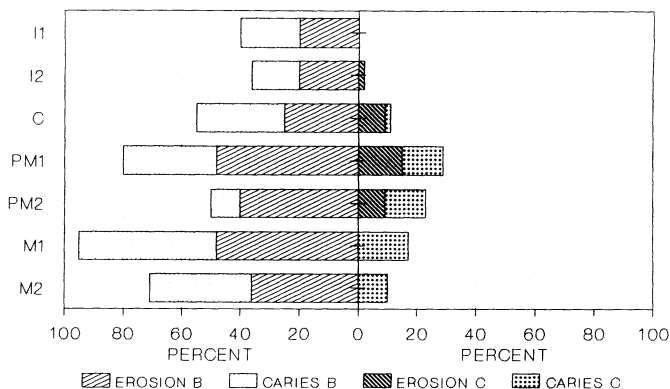


Fig. 2 — Bar chart of percentage of each tooth type with caries and/or erosions on the buccal surfaces of mandibular teeth by group.

MAXILLARY TEETH - PALATAL SURFACE

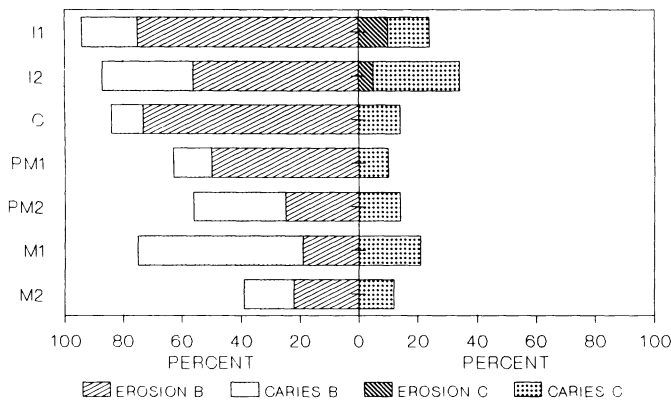


Fig. 3 — Bar chart of percentage of each tooth type with caries and/or erosions on the palatal surfaces of maxillary teeth by group.

bulimics into an investigation because of their secretive nature and because of the social stigma attached to bulimia. Nevertheless, this group was similar in size to that of Hurst *et al.* (1977), although smaller than that of Roberts and Li (1987). The 11 bulimic women could be recruited because the general dental practice serves an area in which there is a psychiatric unit dealing with anorexia nervosa and bulimia, and patients have learned of the dentists' interest in bulimia. Permission to have access to the psychiatric unit was not granted.

The second difficulty arose from the sample size, which is probably why the marked difference in DMFS observed between the two groups was not statistically significant. A final difficulty was the lack of objective information in the dental literature regarding diagnosis and assessment of the extent of erosions. The criteria used in this investigation proved practical, and gave, it is believed, a reasonable assessment of the lesions. Dental caries diagnosis was well-standardized through the use of WHO criteria.

This investigation has clearly shown, in quantitative terms, a higher prevalence of both erosions and dental caries in bulimic subjects, compared with matched controls. This confirms the case reports such as those Hellström (1974, 1977) described in the literature. No comparison with the results of previous workers can be made with regard to either DMFS or erosions, since none of the previous workers quantified their findings.

The present study has highlighted the serious nature of bulimia through the high prevalence of erosions and dental caries in bulimic patients. It is not possible to evaluate the cause of the lesions based on the evidence collected in this study. In our opinion, however, previous speculations on the ingestion of high amounts of fermentable carbohydrates during the bingeing phase of bulimia (Garfinkel and Garner, 1982), combined with the decalcification effect of acidic vomitus during the vomiting phase of the disease, as well as reduced salivary flow (Toone and Lader, 1979) are reasonable.

Stegé *et al.* (1982) have suggested that any patient with moderate to severe dental erosion on the lingual surfaces of the maxillary anterior teeth probably has been or is vomiting on a regular basis. Evidence from our study supports this suggestion, as do Järvinen *et al.* (1988), who studied patients with upper gastro-intestinal tract disorders; Roberts and Li (1987), who examined anorexia nervosa and bulimia nervosa patients; and Simmons and Thompson (1987), who investigated patients with ethanol-induced emesis. Another cause of erosions is the

MANDIBULAR TEETH - LINGUAL SURFACE

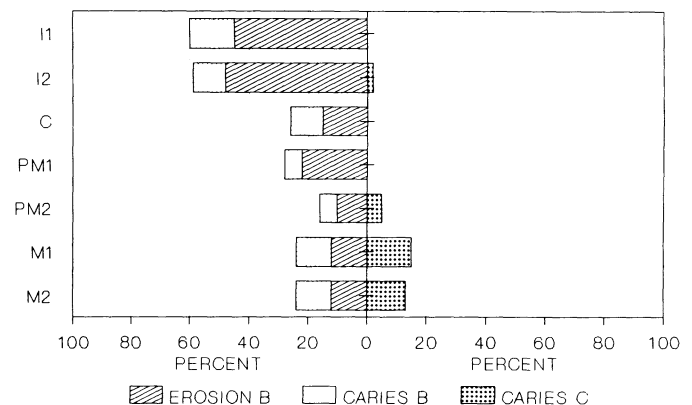


Fig. 4 — Bar chart of percentage of each tooth type with caries and/or erosions on the lingual surfaces of mandibular teeth by group.

excessive intake of citric acid (Schaaf, 1984; Asher and Read, 1987).

Furthermore, we have shown that a high prevalence of erosions on the buccal surfaces of maxillary canines and first premolars, coupled with a low prevalence on the buccal surfaces of maxillary incisors, but a high prevalence on the palatal surfaces of the same teeth, is highly suggestive of bulimia. Further supporting evidence for the diagnosis is the finding in this study that over 50% of bulimic subjects had erosions on these teeth, and over 70% had erosions on the buccal surfaces of the central incisor and canine. Moreover, more than 40% of such patients showed erosions of some degree on the lingual surfaces of the lower incisors.

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REFERENCES

- ASHER, C. and READ, M.J.F. (1987): Early Enamel Erosion in Children Associated with Excessive Consumption of Citric Acid, *Br Dent J* 162:384-387.
- CLARK, D.C. (1985): Oral Complication of Anorexia Nervosa and/or Bulimia, *J Oral Med* 40:134-138.
- CLEATON-JONES, P.; HARGREAVES, J.A.; FATTI, L.P.; CHANDLER, H.D.; and GROSSMAN, E.S. (1989): Dental Caries Diagnosis Calibration for Clinical Field Studies, *Caries Res* 23:195-199.
- DREYER, A.G. and GROBLER, S.R. (1984): Die Fluoriedgehalte in die Drinkwater van Suid-Afrika en Suidwes-Afrika, *J Dent Assoc S Afr* 39:793-797.
- GARFINKEL, P.E. and GARNER, D.M. (1982): *Anorexia Nervosa. A Multidimensional Perspective*. New York: Brunner/Mazel, pp. 1-379.
- HELLSTRÖM, I. (1974): Anorexia Nervosa — Odontologiska Problem, *Swed Dent J* 67:253-269.
- HELLSTRÖM, I. (1977): Oral Complications in Anorexia Nervosa, *Scand J Dent Res* 85:71-86.
- HOLST, J.J. and LANGE, F. (1939): Perimolysis: A Contribution Towards the Genesis of Tooth Wasting from Non-Mechanical Causes, *Acta Odontol Scand* 1:36-48.
- HURST, P.S.; LACEY, J.H.; and CRISP, A.H. (1977): Teeth, Vomiting and Diet. A Study of the Dental Characteristics of Seventeen Anorexia Nervosa Patients, *Postgrad Med J* 53:298-305.
- JÄRVINEN, V.; MEURMAN, J.H.; HYVARINEN, H.; RYTO-

- MAA, J.; and MURTOMAA, H. (1988): Dental Erosion and Upper GIT Disorders, *Oral Surg Oral Med Oral Pathol* 63:298-303.
- OFFICE OF POPULATION CENSUSES AND SURVEYS (1970): **Classification of Occupations**, London: Her Majesty's Stationery Office, pp. 102-119.
- ROBERTS, M.W. and LI, S.H. (1987): Oral Findings in Anorexia Nervosa and Bulimia Nervosa: a Study of 47 Cases, *J Am Dent Assoc* 115:407-410.
- SCHAAF, J.E. (1984): Anorexia Nervosa and Bulimia: Disorders with Oral Implications, *Ind Univ Sch Dent Alumni Bull* 93:14-16.
- SCHLEMMER, L. and STOPFORTH, P. (1979): **A Guide to the Coding of Occupations in South Africa**, Fact Paper No. 4, Centre for Applied Social Sciences, Durban: University of Natal, pp. 1-65.
- SHAW, L. and MURRAY, J.J. (1975): Inter-Examiner and Intra-Examiner Reproducibility in Clinical and Radiographic Diagnosis, *Int Dent J* 25:280-288.
- SIMMONS, M.S. and THOMPSON, D.C. (1987): Dental Erosion Secondary to Ethanol Induced Emesis, *Oral Surg Oral Med Oral Pathol* 64:731-733.
- STATISTICAL ANALYSIS SYSTEM (1985): **SAS User's Guide: Basics**, Version 5 ed., Cary, NC: SAS Institute, Inc., pp. 1-1290.
- STEGE, P.; VISCO-DANGLER, L.; and RYE, L. (1982): Anorexia Nervosa: Review Including Oral and Dental Manifestations, *J Am Dent Assoc* 104:648-652.
- TOONE, B.K. and LADER, M.H. (1979): Salivary Secretion in the Affective Disorders and Schizophrenia, *Acta Psychiatr Scand* 59:529-535.
- WORLD HEALTH ORGANISATION (1977): **Oral Health Surveys**, 2nd ed., Geneva: World Health Organisation, pp. 1-68.