

# Prevalence of Psychologic, Dental, and Temporomandibular Signs and Symptoms Among Chronic Eating Disorders Patients: A Comparative Control Study

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***Aims:** To compare the prevalence of psychologic, dental, and temporomandibular disorder (TMD) signs and symptoms between young women suffering from chronic eating disorders (ED) and a control group of age-matched, healthy women, and to evaluate the impact of frequent vomiting on these signs and symptoms among the ED group. **Methods:** Clinical examination and self-administered questionnaires were used to evaluate psychologic, dental, and TMD signs and symptoms among 79 women hospitalized because of chronic ED and 48 age-matched healthy women (as controls). ED patients were further analyzed according to their habit of daily vomiting (43 vomiting versus 36 nonvomiting patients). Pearson chi-square and analysis of variance were used to analyze categorical differences between study groups. **Results:** Women with ED showed a significantly higher sensitivity to muscle palpation ( $P < .001$ ) and higher levels of depression, somatization, and anxiety ( $P < .001$ ), as well as a higher prevalence of intensive gum chewing ( $P < .001$ ), dental erosions ( $P < .001$ ), and attrition ( $P < .001$ ), than the healthy controls. Vomiting patients showed higher muscle sensitivity to palpation than nonvomiting patients ( $P < .001$ ) and greater emotional and psychologic distress ( $P < .001$ ). **Conclusion:** Women with chronic ED suffer from higher muscular sensitivity to palpation, greater emotional distress, and more hard tissue destruction (dental erosions, dental sensitivity) than healthy women. J OROFAC PAIN 2008;22:201-208.*

**Key words:** anorexia nervosa, bruxism, bulimia nervosa, dental erosion, eating disorders, stress, TMD, vomiting

Eating disorders (ED) present a challenge to researchers and clinicians because of their often fatal consequences.<sup>1</sup> In the Western world, anorexia nervosa and bulimia nervosa are the two main ED, particularly among Caucasian women. Diagnosis is based on clinical parameters according to the criteria of the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* (DSM-IV).<sup>2</sup>

Anorexia nervosa is characterized by the refusal to maintain a minimal normal weight in accordance with age and height, ie, an extreme fear of gaining weight or being fat. Patients tend to feel fat, even when extremely thin. This disease affects mostly adolescent girls, with a prevalence of 0.5% to 1% in the general population.<sup>3</sup>

Bulimia nervosa is characterized by repeated episodes of uncontrolled eating attacks (binge eating), defined as accelerated consumption of large quantities of food within a short period of time, accompanied by compensatory behavior, such as vomiting, use of laxatives, urinating drugs and/or other medication, and fasting or

exaggerated sports activity. Patients are mostly young adult women with a prevalence of 1% to 3% in the general population.<sup>3</sup>

Complications of ED include food aspiration, gastrointestinal ulcers, hypocalcemia, cardiac arrhythmic disorders, pancreatitis, and myopathies (including the myocardium); death may also occur as a result of arrhythmia disorders.

Generally, a combination of psychotherapy, therapeutic treatment, and hospitalization is used to treat ED when required.<sup>1,3</sup> Oral complications include erosion of the lingual tooth surfaces, tooth sensitivity, xerostomia, dental caries, periodontal diseases, hypertrophy of the saliva glands, atrophy of the mucus, and poor oral hygiene.<sup>4-6</sup>

Temporomandibular disorders (TMD) is a collective term embracing several clinical problems that involve the muscles of mastication, the temporomandibular joint (TMJ) and associated structures, or both.<sup>7</sup> The most common symptom is pain, which can be spontaneous and is usually aggravated during mastication, biting, yawning, and even speaking. Other features include disturbances of mandibular movements, such as deviation in mouth opening or restricted range of mandibular movement and noise (clicks and crepitus) in the TMJ. Emotional and psychologic factors frequently accompany or aggravate TMD. Identification of the causes leading to TMD is still incomplete. Apparently, it is a multifactorial phenomenon that involves central factors, as well as predisposing, initiating, and perpetuating factors. Local and systemic contributing factors, such as detrimental parafunctional activities, are usually reported.<sup>8-10</sup>

Frequent vomiting, a common habit among ED patients,<sup>3</sup> causes an acidic oral environment and changes in saliva content that result in damage to the tooth surface because of enamel and dentin erosion.<sup>5,6,11-15</sup> Self-triggered vomiting can result in tooth mobility and/or orthodontic disorders, mainly open bite.<sup>16</sup> The mechanical pressure exerted by frequent self-triggering of vomiting, especially when initiated with the fingers, combs, pins, or other hard objects, may lead to damage resembling that sustained during intubations for general anesthesia<sup>17</sup> (ie, dislocations or subluxations of the condyle caused by extreme, unconventional mouth opening).

Because the act of vomiting may be detrimental to the stomatognathic apparatus, it could be considered as a predisposing, initiating, or perpetuating factor of TMD. Thus, the aims of this study were (1) to compare the prevalence of psychologic, dental, and TMD signs and symptoms between young women suffering from chronic ED (ED group) and a

control group of age-matched, healthy women; and (2) to evaluate the impact of frequent vomiting on these signs and symptoms among the ED group.

## Materials and Methods

### Participants

The Committee for Conducting Research on Human Subjects, under the Helsinki accord, at the Chaim Sheba Medical Center, Tel Hashomer, Ramat Gan, Israel, approved the study. All participants received detailed explanations regarding the objectives of the study and its manner of implementation and gave written, informed consent. Participants were adults who were legally and cognitively capable of understanding the supplied information.

**Study Group.** Eighty-six young women who suffered from chronic ED and were hospitalized at the Weight and Eating Disorders Center, The Chaim Sheba Medical Center, Tel Hashomer, Ramat Gan, Israel, were requested to participate in the study. This government hospital serves patients throughout Israel. In this study, no specific demographic data were collected regarding the ED group. The final study group consisted of 79 women (92% response), ranging in age from 18 to 35 years (mean  $23.46 \pm 3.54$  y), diagnosed with bulimia nervosa ( $n = 29$ ), anorexia nervosa ( $n = 24$ ), or eating disorders not otherwise specified (EDNOS;  $n = 16$ ). Several patients had more than 1 diagnosis and were placed into a mixed-diagnosis group ( $n = 10$ ).

Patients were further divided into vomiting and nonvomiting groups. The vomiting group consisted of 43 patients (mean age  $23.8 \pm 3.5$  y) who reported vomiting as a daily habit for at least 6 months before hospitalization. Patients suffered from bulimia nervosa ( $n = 28$ ), anorexia nervosa ( $n = 8$ ), EDNOS ( $n = 5$ ), and mixed diagnosis ( $n = 2$ ). Average number of hospitalizations was  $1.4 \pm 0.70$  (range: 1 to 4; median of 1).

The nonvomiting group consisted of 36 ED patients (mean age  $23.0 \pm 3.5$  y) who did not report frequent vomiting. Patients suffered from anorexia nervosa ( $n = 16$ ), bulimia nervosa ( $n = 1$ ), EDNOS ( $n = 11$ ), and mixed diagnosis ( $n = 8$ ). The average number of hospitalizations was  $1.4 \pm 0.93$  (range: 1 to 5; median of 1).

No significant differences were found between the vomiting and nonvomiting groups regarding age or hospitalization parameters. Hospitalization period was up to 3 months.

**Control Group.** Fifty healthy female students studying in a 2-year course of Dental Hygienists at the Maurice and Gabriela Goldschleger School of Dental Medicine, Tel Aviv University, Tel Aviv, Israel, were requested to participate in the study. The final group consisted of 48 female students (96% response) who ranged in age from 18 to 36 years (mean  $24.58 \pm 3.01$  y).

No significant differences were found between the ED and control groups regarding age.

## Research Tools

The study consisted of questionnaires completed by patients and control subjects and a clinical examination performed by 2 examiners. Similar to previous studies,<sup>18,19</sup> one examiner performed the extraoral clinical examinations, and the other performed all intraoral examinations. Both examiners were blind to the clinical findings of the other and to the data obtained by the questionnaires.

**Self-Administered Questionnaires.** *Questionnaire Referring to TMD Symptoms and Oral Habits.* This questionnaire investigated 5 different areas.

1. Limitation in mouth opening was defined as self-report of at least 1 of the following symptoms (yes/no scale): inability to fully open the mouth, joint catch (sudden catching of the joint preventing full mouth opening but spontaneously resolved), or joint lock (limited mouth opening and the feeling that the jaw is locked without the possibility of releasing itself).
2. Tooth sensitivity in response to mastication was defined as a self-report of sensitivity when exposed to at least one of the following stimuli: cold, sweet foods, or sour foods (yes/no scale).
3. Prevalence of chewing gum was included (average chewing time per day, in hours, before hospitalization; forbidden during hospitalization).
4. Performance on a daily basis of oral habits, such as biting nails, biting hard foreign bodies, grinding ice or candy, and continuously leaning the head on the palm of the hand (yes/no scale).
5. Awareness of awake bruxism (self-awareness of tooth clenching or grinding while awake [yes/no]); presence of sleep bruxism (one of the following signs: self-awareness, bed partner's or parent's report regarding bruxism, pain or stiffness in the jaw area upon awakening, morning headache, joint click at the first mouth opening in the morning that disappears in later opening, on a yes/no scale).

**Emotional and Psychologic State.** Participants were asked to complete the Axis II questionnaire of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD).<sup>20</sup> Several Axis II questions were derived from the Symptom Check List-90 (SCL-90) (validated Hebrew version<sup>21</sup>), which referred to depression, somatization, and anxiety. Each item was scored as follows (for a detailed description of scales and mode of calculation, see Dworkin and LeResche<sup>20</sup> and Roskin and Dasberg<sup>21</sup>):

1. Depression and vegetative symptoms (0 to 4 scale, 20 items)<sup>21</sup>; range of scores: < 0.53 = normal, 0.53 to 1.10 = moderate, > 1.10 = severe
2. Somatization scale, pain items included (0 to 4 scale, 12 items)<sup>21</sup>; range of scores: < 0.50 = normal, 0.50 to 1.00 = moderate, > 1.00 = severe
3. Somatization scale, pain items excluded (0 to 4 scale, 7 items)<sup>21</sup>; range of scores: < 0.42 = normal, 0.43 to 0.86 = moderate, > 0.86 = severe
4. Anxiety scale (0 to 4 scale, 10 items)<sup>21</sup>; range of scores: < 0.44 = normal, 0.44 to 1.10 = moderate, > 1.10 = severe

An additional Axis II item was calculated and included:

5. Characteristic pain intensity<sup>20</sup> (CPI): the arithmetic mean of 3 items referring to pain: degree of pain at present, degree of worst pain experienced, and degree of average pain experienced (0 to 100 scale).

**Clinical Examination.** *TMD Signs.* A clinical examination was performed according to the RDC/TMD principles.<sup>20</sup> Only the following signs of TMD were recorded:

1. Range of active mouth opening (AMO) (interincisal distance during voluntary opening, in mm).
2. Range of passive mouth opening (PMO) (maximal opening, under slight pressure on the incisal teeth, in mm).
3. Presence of clicks and/or crepitation during opening, closing, or lateral movements, measured during palpation of the TMJ area. This was considered positive only if noises were present at least in 2 of the 3 consecutive examinations (yes/no).
4. Joint sensitivity, ie, sensitivity to digital palpation of the lateral side of the joint under pressure of about 0.5 kg (scale, 0 to 3). High sensitivity was defined as at least 2 in a scale of 0 to 3.

- Muscle sensitivity to digital palpation, ie, sensitivity (scale of 0 to 3) following application of pressure of about 1 kg in the area of the superficial and deep masseter muscle (4 sites) and the anterior part of the temporalis muscle (2 sites). Initially, mean sensitivity was computed separately for each muscle (mean of the palpated sites for each muscle). At a second stage, mean sensitivity of the 6 sites was computed and defined as general muscular sensitivity to palpation (GMS).

#### *Examination of Hard Tissues Inside the Oral Cavity.*

- Existence of worn facets on canines was assessed according to a modification of Johansson et al.<sup>22</sup> Scores were calculated as: 1 = no facets or only light wear (on enamel or on enamel and dentin) or 2 = massive wear of cusps (complete loss of cuspal anatomy). The most severely worn canine was registered for each patient.
- Presence of tooth erosion was examined on the palatal surface of the 6 anterior teeth (incisors and canines) and on the buccal surfaces of the mandibular first molars. Scoring system and criteria used to diagnose erosion were as follows<sup>23</sup>: 0 = no evidence of tooth wear, no loss of enamel surface features, no change of contour; 1 = tooth wear into enamel, loss of enamel surface features giving a smooth glazed, shiny appearance, dentin not involved; 2 = tooth wear into dentin, extensive loss of enamel with dentin involvement; 3 = tooth wear into pulp, extensive loss of enamel and dentin with pulp exposure; or 4 = could not be assessed because of extensive caries, fractures, large restorations, or missing teeth. The most severely eroded tooth was registered.

#### **Statistical Analysis**

The Department of Biostatistics at the university performed the statistical analysis using SPSS statistical software (version 11.0). Pearson chi-square for qualitative variables was used to evaluate differences between groups. Analysis of variance (ANOVA) and the Tukey studentized range method for multiple comparisons were used to analyze categorical differences between study groups (control, vomiting, and nonvomiting). All results were Bonferroni corrected to reduce the possibility of type 1 error. In all cases, 2-tail tests were used, and the probability and 95% confidence intervals were computed from these results ( $P < .05$ ). When  $P$  was equal to .000, it was recorded as  $P < .001$ .

## **Results**

### **Comparison of ED and Control Groups**

**Self-Reported Symptoms and Oral Habits.** The ED group reported more frequent limitation in mouth opening (20.3% vs 6.3%, respectively), higher prevalence of tooth sensitivity (70.9% vs 50%, respectively), and a higher prevalence of intensive gum chewing (more than 3 hours/day<sup>9,10,18</sup>) than the control group (68.8% vs 17.9%, respectively;  $P < .001$ ). However, only the last finding reached statistical significance after Bonferroni correction.

No differences were found between ED and control groups for self-report of parafunctional activity (ie, nail biting, biting of pencils and pens, breaking ice, leaning chin or face on palm, jaw play) (91.1% vs 85.4%, respectively), bruxism performed during waking (38% vs 25%, respectively), bruxism during sleeping (19% vs 29.2%, respectively), and joint sensitivity or tension (15.4% vs 14.6%, respectively).

**Emotional and Psychologic State.** Significant differences ( $P < .001$  after Bonferroni correction) were found between ED and control groups regarding scores for depression, nonspecific physical symptoms (somatization, pain items included and excluded), and anxiety. Based on the SCL-90,<sup>21</sup> all mental parameters (depression, somatization, and anxiety) were defined as severe in the ED group and moderate in the control group. No significant difference was found for the CPI<sup>20</sup> score.

**Clinical Extraoral Examination.** GMS was higher in the ED group ( $1.12 \pm 0.88$ ) than in the control group ( $0.21 \pm 0.39$ ) ( $P < .001$  after Bonferroni correction).

No significant differences were found between groups for joint sensitivity to palpation (a score of 2 was present among 26% of the ED group and 14.6% of the control group).

Range of mouth opening (AMO, PMO) was similar in both groups: ED ( $51.2 \pm 6.9$  mm for AMO and  $53.6 \pm 7.0$  mm for PMO), control ( $50.8 \pm 7.0$  mm for AMO and  $53.3 \pm 7.2$  mm for PMO). No significant difference was found between groups regarding the presence of joint clicks (24.7% in ED vs 29.2% in control). None of the participants exhibited crepitation.

**Clinical Intraoral Examination.** Significant differences between groups were detected for the presence and severity of attrition and severity of dental erosions. Severe attrition was found in only 4.2% of the control group, compared to 42.4% in the ED group ( $P < .001$  after Bonferroni correction). There were no erosions that affected the dentin in the control group, but in the ED patients, dentinal erosions

**Table 1 Multiple Comparisons of Mean Scores Between Groups for TMD Symptoms and Oral Habits**

	C (%)	EDnv (%)	EDv (%)	P		
				Initial	After correction	Between groups
Limitation in mouth opening	6.3	11.1	27.9	.009	.05*	EDv = EDnv*; EDv > C*
Tooth sensitivity	50.0	55.6	83.7	.001	.005*	EDv > EDnv = C*
Prevalence of oral habits	85.4	91.7	90.7	NS	NS	EDv = EDnv = C
Intensive gum chewing (more than 3 h/day)	17.9	58.6	77.1	< .001	< .001*	EDv = EDnv > C*
Clenching while awake (bruxism)	25	33.3	33.3	.04	NS	EDv = EDnv = C
Sleep bruxism	29.2	8.3	27.9	.04	NS	EDv = EDnv = C

C = control; EDnv = eating disorder nonvomiting; EDv = eating disorder vomiting; initial = before Bonferroni correction; after correction = after Bonferroni correction; NS = not significant.

\*Pearson chi-square; significant result (after correction).

**Table 2 Multiple Comparisons of Mean Scores Between Groups for Emotional and Psychologic State**

	C (%)	EDnv (%)	EDv (%)	P		
				Initial	After correction	Between groups
Depression**	0.7	1.72	2.30	< .001	< .001*	EDv > EDnv > C*
Somatization** (pain included)	0.70	1.38	2.20	< .001	< .001*	EDv > EDnv > C*
Somatization** (pain excluded)	0.57	1.49	2.21	< .001	< .001*	EDv > EDnv > C*
Anxiety**	0.70	1.64	2.08	< .001	< .001*	EDv = EDnv > C*
CPI	12.75	15.60	33.56	< .001	< .001*	EDv > EDnv = C*

EDnv = eating disorder nonvomiting; EDv = eating disorder vomiting; CPI = characteristic pain intensity; initial = before Bonferroni correction; after correction = after Bonferroni correction.

\*Significant result; ANOVA followed by Tukey studentized range method for multiple comparisons.

\*\*Variables as defined in text.

were found in 26.3% of the examined maxillary anterior teeth and 21.3% of the posterior teeth ( $P < .001$  after Bonferroni correction).

### Comparison of Vomiting and Nonvomiting ED Patients

**Self-Reported Symptoms and Oral Habits.** There were no significant differences (after Bonferroni correction) between the vomiting and nonvomiting groups with regard to self-report of limitation in mouth opening, performance of different oral habits on a daily basis (eg, biting nails, biting hard foreign bodies, grinding ice or candy), chewing gum for more than 3 hours per day, self-report of bruxism while awake, and clenching or bruxing while asleep (Table 1). However, self-reported tooth sensitivity was significantly higher among the vomiting group (83.7%) compared with the nonvomiting group (55.6%) ( $P = .005$  after Bonferroni correction; Table 1).

**Emotional and Psychologic State.** Significant differences were found between vomiting and nonvomiting groups for depression ( $P < .001$  after Bonferroni correction) and nonspecific physical

symptoms (somatization, pain items included;  $P < .001$ ; pain items excluded,  $P < .001$ ; both after Bonferroni correction), with patients who reported daily vomiting showing significantly higher scores than nonvomiting patients. No significant differences were found regarding anxiety scores or disability scores between groups. Nevertheless, the CPI was significantly higher among the vomiting group ( $P < .001$  after Bonferroni correction; Table 2).

**Clinical Extraoral Examination.** The vomiting group showed a significantly higher GMS ( $P < .001$  after Bonferroni correction), but no difference was found between groups in sensitivity to palpation of the TMJ (Table 3). The vomiting group showed no significant differences (after Bonferroni correction) for AMO and PMO versus the nonvomiting group. There was also no difference between groups regarding the presence of joint clicks (Table 3). None of the participants exhibited crepitation.

**Clinical Intraoral Examination.** Generally, the vomiting group had a higher level of dental erosion and exhibited more severe canine attrition compared to the nonvomiting group, but the differences did not reach statistical significance (Table 4).

**Table 3 Multiple Comparisons of Mean Scores Between Groups for TMD Signs**

	C* (%)	EDnv* (%)	EDv* (%)	P		Between groups*
				Initial	After correction	
AMO	50.8	48.83	53.26	.018	NS	EDv = C = EDnv
PMO	53.3	51.51	55.43	.051	NS	EDv = C = EDnv
GMS	0.21	0.88	1.33	< .001	< .001**	EDv > EDnv > C**
Clicks/crepitation (%)	29.2	22.9	26.2	NS	NS	EDv = C = EDnv
Joint sensitivity (%)	14.6	17.1	33.3	NS	NS	EDv = C = EDnv

EDnv = eating disorder nonvomiting; EDv = eating disorder vomiting; NS = not significant; initial = before Bonferroni correction; after correction = after Bonferroni correction.

\*ANOVA followed by Tukey studentized range method for multiple variables for AMO, PMO, and GMS; Pearson chi-square for clicks/crepitation and joint sensitivity.

\*\*Significant result after Bonferroni correction.

**Table 4 Multiple Comparisons of Mean Scores Between Groups for Hard Tissues Inside Oral Cavity**

	C (%)	EDnv (%)	EDv (%)	P		Between groups
				Initial	After correction	
Erosion	0	17.6	33.3	<.001	< .001**	EDv = EDnv > C**
Attrition	4.2	34.3	47.6	<.001	< .001**	EDv = EDnv > C**

C = control; EDnv = eating disorder nonvomiting; EDv = eating disorder vomiting; initial = before Bonferroni correction; after correction = after Bonferroni correction.

\*Pearson chi-square.

\*\*Significant result after correction.

**Multiple Comparisons Between Study Groups**

Multiple comparisons were performed to compare the 3 different groups: control, ED nonvomiting patients, and ED vomiting patients (Tables 1 to 4). Generally, the following pattern emerged:

- ED patients, especially the vomiting group, showed a significantly higher prevalence of intensive gum chewing than the control group, and there was significantly higher tooth sensitivity in the ED vomiting patients compared to the other groups (Table 1).
- Generally, ED patients showed significantly higher emotional and psychologic distress compared to the control group, with the vomiting group being more distressed than the nonvomiting group (Table 2).
- ED patients (both vomiting and nonvomiting) showed significantly higher GMS than the control group, with the vomiting group showing the highest sensitivity of the 3 groups (Table 3).
- ED patients showed a significantly higher degree of destruction of hard dental tissues than the control group (Table 4).

**Discussion**

Little is known about possible associations between chronic ED<sup>3</sup> and TMD<sup>7,8</sup> in spite of their relatively high prevalence in Western society. Both involve

function and parafunction of the oral cavity. The present study showed that women with ED presented higher GMS than healthy women of the same age, as well as higher emotional and psychologic distress. This may suggest a higher susceptibility of women suffering from ED to suffer also from myofascial pain than healthy subjects. Most differences did not reach statistical significance, probably because of the small number in each group and the application of the Bonferroni correction for multiple testing. However, the results clearly indicate some disparity between the 2 groups.

Patients suffering from ED often experience lack of sleep, tension, and severe distress and are usually treated with antidepressant medications; all these factors have the capacity to encourage bruxism.<sup>24</sup> The combination of chemical erosion on the tooth surfaces and attrition caused by bruxism has a severe detrimental effect on dental tissues.<sup>6</sup> Similarly, in the present study, significant differences between ED groups were detected regarding the presence and severity of attrition and severity of dental erosions versus a sex- and age-matched, healthy control group. Patients with ED also showed a higher sensitivity to palpation of the superficial masticatory muscles than healthy individuals. The relationship between ED and pain is controversial. In one study, approximately 71% of ED patients reported some form of current or recent facial pain.<sup>25</sup> In another, patients with anorexia nervosa exhibited a significantly higher pressure-pain threshold, probably because of an

elevation in endorphins or dysregulation of the serotonergic system.<sup>26</sup> Patients with bulimia nervosa showed similar characteristics.<sup>26,27</sup> The higher sensitivity to palpation of the masticatory muscles among ED patients may be caused by intensive gum chewing, as previously shown,<sup>9,19</sup> or it may be a result of the influence of the autonomic nervous system, as explained by Okeson.<sup>17</sup> Goldberg et al<sup>25</sup> recently described the possible coexistence of chronic pain in an ED population. Facial pain was reported in 61% of the ED group. It was concluded that the presence of chronic pain may interfere with the treatment provided to these patients.

Chronic ED have significant emotional and psychologic effects.<sup>28,29</sup> Not surprisingly, in the present study, women with ED suffered from higher levels of depression, anxiety, and somatization than their age-matched counterparts.

Vomiting is a prevalent and potentially destructive symptom of ED, with significant dental and medical morbidity. Reba et al<sup>30</sup> suggested that certain clinical and personality variables distinguish individuals with purging-type ED who vomit from those who do not, although there were no marked differences in Axis I or II morbidity. In the present study, patients who frequently vomited had greater emotional and psychologic distress compared to nonvomiting patients, which agrees with the scientific literature.<sup>31-33</sup> The relationship between sleep bruxism and psychologic distress is still controversial,<sup>34</sup> with increasing evidence toward a possible causal relationship between bruxism and various psychologic factors.<sup>35</sup> The fact that the ED group exhibited a concomitant greater emotional and psychologic distress and a higher level of dental attrition than their age-matched counterparts may contribute to this discussion.

Oral habits (parafunctional behaviors) are common and usually do not harm the stomatognathic apparatus. However, when the activity exceeds the individual's physiologic tolerance, the system begins to alter and may break down. Initial breakdown is seen in the tissue with the lowest structural tolerance (dentition, musculature, or joints).<sup>8</sup> The prevalence of oral habits and their association with signs and symptoms of temporomandibular dysfunction have been reported.<sup>9,10,18,19</sup> Microtrauma, defined as repeated application of small forces, could be a possible cause of TMD.<sup>8</sup> Frequent vomiting can be considered as a microtrauma but may occasionally be seen as a macrotrauma, since it is accompanied by extreme, sudden, unconventional mouth opening. Apparently the vomiting activity affects both the masticatory muscles and tendons, leading to the development of myofascial symp-

oms. The assumption that myalgia of the masticatory muscles stretched during vomiting resulted in the development of protective cocontraction can be rejected, since no statistical differences were found regarding range of mouth opening. Nevertheless, it should be noted that patients were examined during hospitalization that had lasted for up to 3 months, a period during which vomiting was forbidden and strictly prevented. This fact may have attenuated differences between historical vomiters (previous to hospitalization) and nonvomiting patients. Accordingly, it is possible that the mouth opening of vomiting patients during active vomiting periods is restricted, possibly because of protective cocontraction, as proposed in the Pain Adaptation Model.<sup>36</sup> No difference was found between the vomiting and nonvomiting groups regarding joint clicks, which may indicate that the act of vomiting mainly affects the mouth musculature and not the location of the articular disc.

### Study Limitations

Definite conclusions cannot be made because of several limitations of the study:

1. Relatively small groups were used.
2. Only signs of TMD were recorded. Indices (including the RDC/TMD) make the associations more complex, since their value is based on multiple variables. A single symptom or sign from the masticatory system is not synonymous with TMD; nor does it automatically lead to a TMD diagnosis.
3. Demographic variables were not collected, and their possible effects were not evaluated.
4. Time since onset of the disease and individual time of hospitalization were not considered.
5. Assignment of patients to the nonvomiting group did not necessarily mean that they had never vomited. The cutoff point was "vomiting on a daily basis." Also, the amount of daily vomiting (in the vomiting group) was not assessed.
6. Although clinical examinations were carried out by expert clinicians in the field of TMD who have conducted numerous similar studies on the subject,<sup>9,18,19</sup> no explicit reliability tests were conducted prior to the study.

### Conclusions

Patients with chronic ED may be more susceptible to muscle sensitivity and pronounced emotional and psychologic stress than healthy individuals.

This calls for further attention of the medical and dental communities. Because family physicians and dentists are often the first to recognize the relevant signs of ED, it is recommended that dental clinicians keep in mind ED and their possible consequences during the evaluation and treatment of their patients. Nonetheless, these conclusions should be considered with care, especially given the study limitations. Further research is necessary to determine whether possible comorbidity exists between ED and TMD in general and with ED vomiting patients in particular.

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